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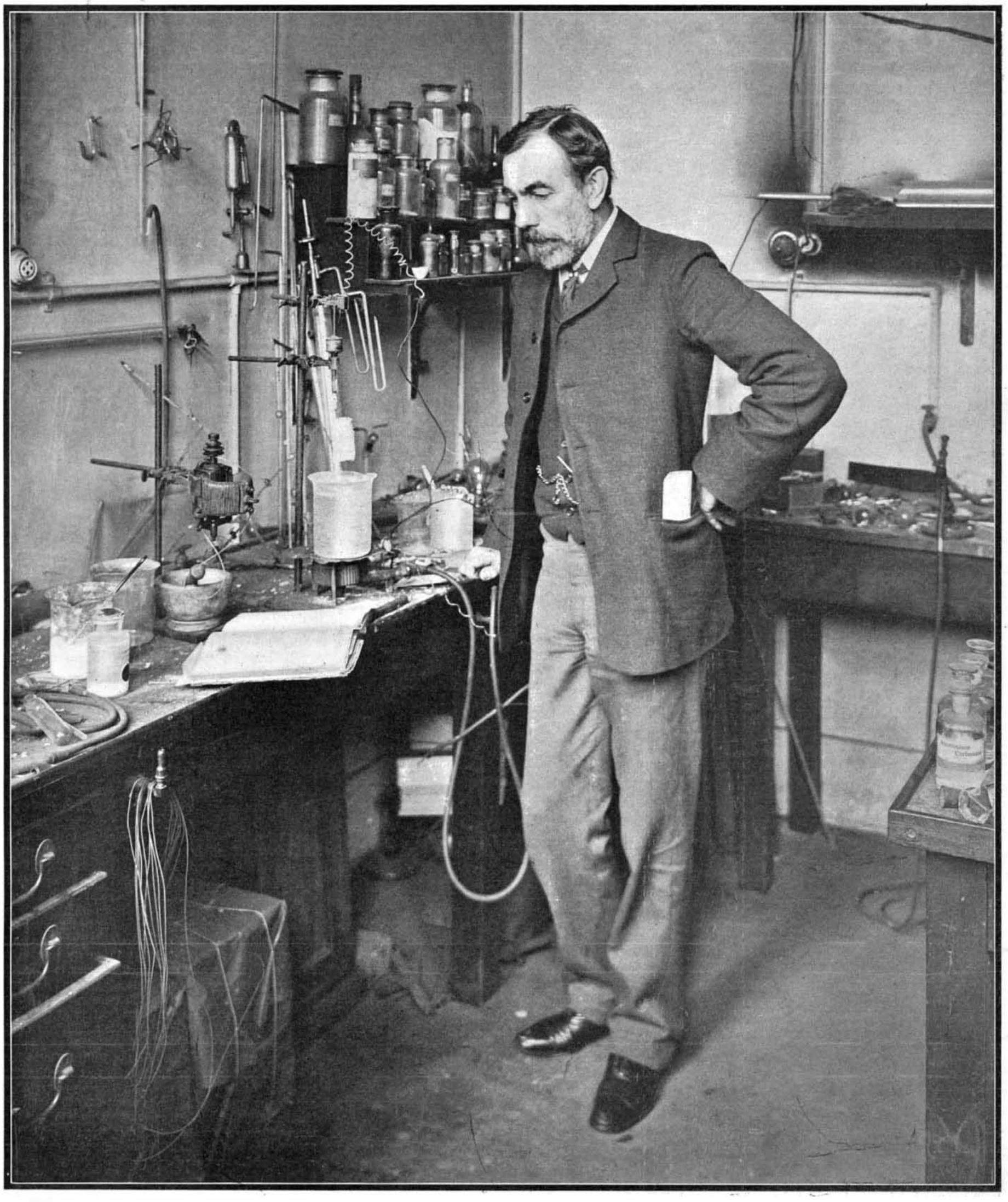

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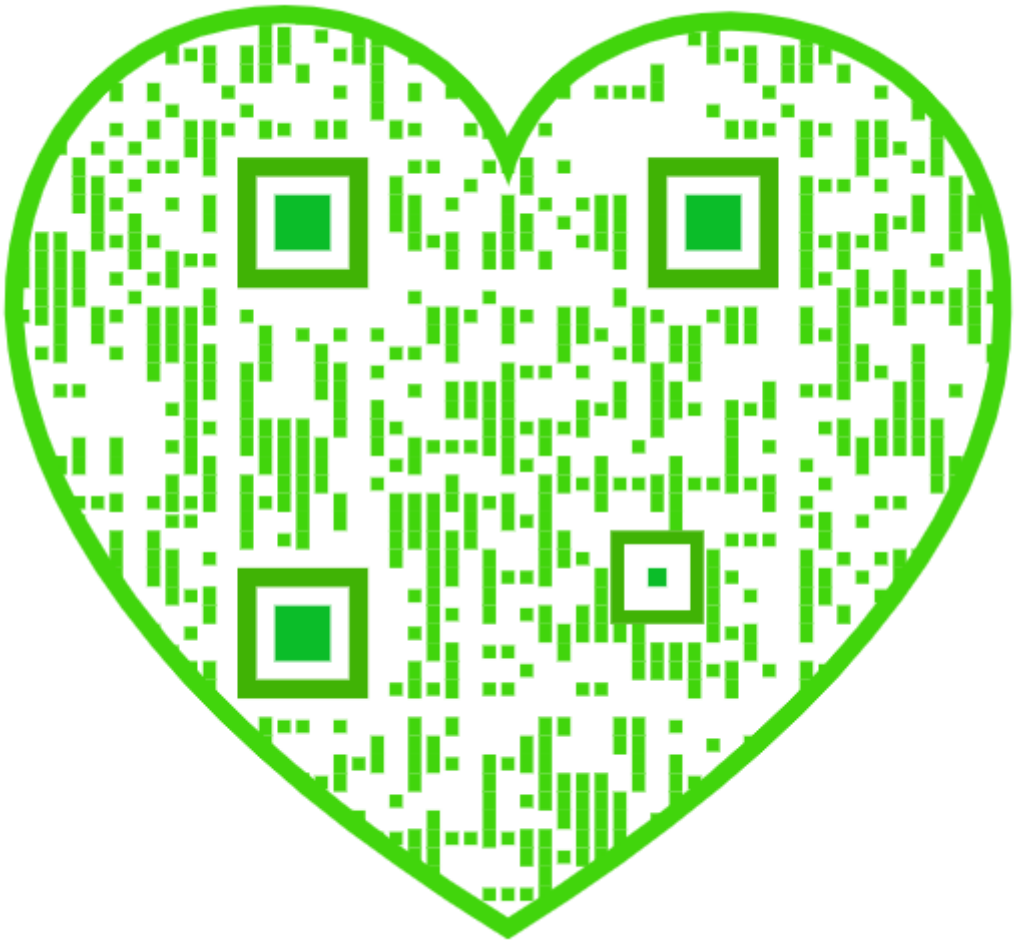
William Ramsay.

THIS PHOTOGRAPH OF SIR WILLIAM RAMSAY WAS TAKEN IN HIS LABORATORY SPECIALLY FOR THE SCIENTIFIC AMERICAN.—[See page 62.]



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NEW YORK, SATURDAY, JULY 23, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

WHAT WE INHERIT WITH THE PANAMA CANAL.

With American control of the Panama canal opening the second chapter in the story of the great isthmian waterway, we inherit a graveyard of many wrecked hopes and lives, with their monuments strewn from the Atlantic to the Pacific in the shape of decaying relics of an earlier engineering period. There is no richer digging in the ruins of an ancient Rome or Pompeii than along the deserted route of the canal. For upward of a quarter of a century some $20,000,000 worth of decaying machinery, buildings, and engineering implements have been buried in the moist soil. In nothing was the early French company more extravagant than in purchasing supplies for the isthmus. These included nearly everything that man could think of, and the shipments of the goods to the isthmus kept employed a small fleet of large and small ships. Every steamer that touched the isthmus in those palmy days of canal digging unloaded stacks of supplies for the engineers and their subordinates.

There was machinery by the scores and thousands of tons, large, small, and medium size; costly machinery and antiquated types of no real value at all; machinery that was to be used, and machinery intended for waste; machinery that was as much out of place in that far-away corner of the earth as steam radiators in the Desert of Sahara. Why this endless amount of machinery was shipped there, no one could explain; but it was all accepted, paid for, and then left to rot in the hot, moist climate. There were locomotives from Belgium and the United States, enormous steam hammers from England, great turning lathes from Germany, scoops, buckets, steel rails, and machine tools by the acre from all parts of the earth.

There were no storehouses sufficient to hold all these supplies. There are 2,431 buildings on the isthmus left by the old Panama company, many of which are hospital buildings and executive offices, but not all of these could store the machinery sent down to help dig the canal. What wonder, then, that machinery became ordinary articles of common use? Engineers and contractors stored what they could, and turned the rest out of doors to the tender mercy of a climate that quickly destroys steel and iron.

There were some who used the iron as foundations for their costly homes. Along the line of the canal, the silt of the soil is often as soft and slippery as quicksand. It filters through and into everything. It made the building of the canal a difficult engineering problem for the French, which they could never quite overcome. When you build substantial houses of stone or iron upon the running soil, there is no surety that the foundations will last. Some of the large houses built by the French officers of the company sank down into the silty soil, until to-day only the upper stories are visible. So, to make their homes more secure, some of them used the surplus machinery as foundations. There are houses on the isthmus that stand on $50,000 worth of machinery, which was never used for the purpose intended.

In many similar ways the surplus machinery was employed to keep it from standing idle. In parts of the isthmus it is found buried ten and fifteen feet below the surface soil. Unearth it, and you find it as soft and porous as cheese. It may be a huge iron anchor, a steel bucket, or a cast-iron scoop, that protrudes above the soil to attract the attention. With a penknife it can be cut and pared as easily as if it were an apple. In some mysterious way, the soil and climate has disintegrated the metal, so that its hardness has disappeared, and while retaining all of its outline and outward characteristics, it is no longer iron or steel. One wanders along the line of the canal to pick up odd pieces of relics, only to find them crumbling under the touch.

Not all the machinery, however, has been cast aside to sink into the loose soil of the canal. At Colon and Emperador it is scattered over miles of land that has been set aside for this purpose. Here, indeed, is the graveyard of France's past ambitions. One stumbles upon the monuments of a past which will forever live in the memory of those in any way associated with the Isthmus of Panama or the canal. Millions upon millions of useless, rotting, neglected property stands exposed to the disintegrating influences of the climate, sadly out of date now and fit only for the junk pile, but teeming with memories and possibilities of the glorious past.

There are miles upon miles of steel rails piled six feet high, sinking slowly into the soft soil, and rusting in the moist atmosphere. Rows upon rows of car wheels are apparent on every side, wheels which represent huge expenditures, but which were apparently simply dumped there and never used. Iron and steel buckets and scoops form an army of silent witnesses to man's folly and wasteful extravagance. Machine shops, filled with huge steam hammers and giant turning lathes for repairing the machinery used in excavating, are falling apart by their own weight. A dozen rows of locomotives—small in size and weight, and scarcely adapted to the work required of them—stand half sheltered under sheds that are themselves hardly able to stand up under their aged and weakened rafters. Rust and decay are apparent on these locomotives, as well as upon all other articles of use, and the hand of neglect appears stretched over the whole length and breadth of the isthmus.

When the trade winds die out, and the hot, sultry air of the isthmus ceases to move, a white mist will sometimes rise out of the swelling ocean, and hover like a fog over land and sea. This white mist is the precursor of fever and sickness, and those of the isthmus who know remain within doors, unwilling to meet the ghost of the ocean half way.

In the early days of the canal history, the white mist that rose from the disturbed soil of the isthmus was far more disastrous in its killing effects than the mist of the ocean. It rose from the soil like incense from a brazier. It carried with it from its underground prison all the poison of putrefaction, and wherever it inclosed its victims, there fever and death followed. The soil is moist and damp, and when disturbed in that hot climate, it releases a dense white mist. For generations past luxuriant vegetation has been decaying in the soil, and when the surface is scratched, strange, unhealthy gases and poisonous vapors rush upward to spread around. Tier upon tier of annual crops of rich vegetation are packed down solid over the surface of the soil. In this hotbed of feverish decomposition, the process of fermentation and disintegration is ever in active operation. Fortunately, nature holds most of the deadly exhalations in close prison walls; but when man comes along to disturb the even balance, trouble begins. In the hot, damp air of the isthmus, the poisonous exhalations released from the soil mingle with the mist, and the "white ghost of the canal" is accounted for. When the Frenchmen excavated for the canal, the mist hovered over their camps and homes during the greater part of the year. It entered nearly every home to claim its victims. Men died like beasts in the field. They were stricken at their work, in their tents, in their beds, and even at the gaming or wine and card table. It was all one with the monster; it knew neither rank nor condition, wealth nor poverty. Only the native knew enough to avoid it, and to keep away from the fever camps of the company.

COST OF ELECTRIC HEATING.

Efficiency in electric heaters is perfect at one hundred per cent. In other words, all of the energy absorbed as electric current reappears as heat.

This is true of no other type of heater. An ordinary coal or wood stove gives off only one-quarter to one-half of the heat energy of its fuel. Radiators in the best steam and hot-water plants yield about seventy per cent of the latent heat of the coal burned in their boiler furnaces.

The remainder of the fuel energy escapes from the boilers in the latent heat of the unburned gases, and as sensible heat of the products of combustion.

Gas heaters, like stoves and furnaces that burn wood and coal, are subject to losses of heat because of imperfect combustion and also because of the high temperature of the escaping products. Probably fifty per cent is as high an efficiency as can ordinarily be expected with gas stoves.

All of the foregoing applies to those cases where electric heaters, wood, coal, or gas stoves, or steam or hot-water plants are employed to warm the air in buildings. Where either coal or gas stoves or furnaces are used for cooking or industrial operations the efficiency between the fuel and the work is in almost all cases an unknown quantity. Thus, who can say how much of the contained heat energy of fuel enters a mass of bread baked by it; or what percentage of the heating power of gas or coal is absorbed by a smoothing iron? About all that can be done in such cases is to determine how much fuel must be expended per pound of bread baked or for each smoothing iron per hour when maintained at a given temperature.

In almost every instance where combustion is employed to develop the heat for industrial operations there is a great and necessary loss between the fire and the object to be heated. This is due in part to the fact that the fire and its containing stove or furnace is large and the object to be heated is small, so that while heat is escaping by radiation and conduction in every direction, it is utilized in only one.

Where electric heaters are applied to industrial operations, most of these losses just named are avoided, because the energy is transformed at or within the object to be heated. Thus an electric stew-pan has the heat developed in coils attached to its bottom, and such coils are actually within the electric smoothing iron. This feature gives electric heating a great advantage in point of economy for most industrial operations. So great is this advantage, that in most industrial applications of heat it is probably necessary to burn several times as much fuel if the heat is transmitted directly to the objects on which it is to act as when it is developed there by electric current. It seems certain, therefore, that electric supply systems can well afford to make rates for current that will insure its application to cooking on a large scale and to special heating in manufacturing plants, especially where current for these purposes can be delivered at times during each twenty-four hours when the power and lighting loads are much below their maximum. Users of heat for special purposes find it to their advantage to pay something more than their former expense for fuel in order to procure electric current to do the same work, because the labor and risk of local fires are thus saved. Applications of electric heat along industrial lines are now rapidly multiplying and its ultimate triumph in that field seems assured.

For the general heating of the air in buildings the prospects are not so encouraging. Even here it seems, however, that there are many cases where electric heaters may displace those that burn coal or gas. The range of the problem may be gathered from the fuel cost of heat from gas or coal. Even in years when there is no strike among the miners $7 per ton is not an unusual price for the first grades of anthracite coal. At this price per ton of 2,000 pounds the cost per pound is 0.35 cent. Each pound of such coal yields on perfect combustion about 12,000 heat units, but in house fires generally the heating effect actually obtained is probably no more than 30 per cent of this, or say about 3,600 heat units per pound. One kilowatt hour of electrical energy is the equivalent of 3,438 heat units, and many electric systems are now able to deliver this amount of energy to consumers on a consumption of three pounds of soft coal costing 0.33 cent when this coal can be had at $2.50 per ton of 2,240 pounds in carload or shipload lots. Under the several assumptions just made it appears that the cost of fuel in the electrical supply system per kilowatt hour delivered is just about equal to the cost of anthracite coal to develop an equivalent amount of heat on the premises of a consumer. The question then is whether consumers will pay enough above the amount which either they or the electric supply company must expend for fuel, to induce that company to operate its plant for heating when the power and lighting loads are small. Considering the saving of labor to consumers, the fact that electric heat can be applied instantly when wanted, and that no combustion or gases accompany its production, it seems that this question must have an affirmative answer in many cases.

Illuminating gas is finding extending application in the warming of buildings, but in safety and in its effect on confined air it is much inferior to electrical energy for this purpose. It is also sound to assert that during many hours in each twenty-four electrical energy can be profitably sold for heating at rates that make it at least as cheap as illuminating gas at the lowest common prices.

Comparatively few cities in the United States have a rate as low as $1 per 1,000 cubic feet for illuminating gas. At this rate the entire heating power of the gas obtained for one dollar is about 650,000 heat units, but owing to imperfect combustion and to the high temperature of the burned gases, hardly more than 325,000 units of heat are made available for general warming with ordinary gas stoves, for each thousand feet of gas consumed. This gives 3,250 heat units for one cent. At the rate of one cent per kilowatt hour the electric heat available for that sum is 3,438 units, or a little more than that obtainable from gas at an equal cost. As low a rate as one cent per kilowatt hour is already made in many instances to large users of electric motive power during the regular working

hours of each day. For a load like electric heating, that extends over the entire twenty-four hours of each day, an even lower rate might be made with profit to the supply system.

When the cheapness of electric heat is better understood by the public, and the desirability of all-day loads is more fully appreciated by central station managers, a great increase in the application of electric current to heating for industrial and general purposes is sure to follow.—Alton D. Adams.

STUDY OF FOREST CONDITIONS.

A study of forestry seems to be especially esteemed in countries where there are no longer forests to study. Realizing how vital to the welfare of a nation is the preservation of its forests, the United States is making an endeavor to study and improve the forests of this country while there is yet time to preserve them. In furtherance of this work the United States Geological Survey has just published a paper which bears the title "Forest Conditions in the San Francisco Mountains Forest Reserve, Arizona."

The San Francisco Mountains Forest Reserve comprises portions of the broad summit and slopes of an elevated tract of land in north-central Arizona, which includes the southern part of the Colorado Plateau. The northern part of the area is dotted by several hundred volcanic cones and the southern part is gashed by numerous deep canyons. The altitude of the region ranges from 3,500 feet at Oak Creek in its southwestern portion, to 12,794 feet at the summit of San Francisco Peak.

Among the coniferous trees in the reserve the yellow pine constitutes over 99 per cent of the total forest. The aspen takes first rank among the broad-leaved species, but has a close competitor in the oak. The chief lumber tree at present is the yellow pine, which is extensively cut and furnishes all of the mill timber sawed, used in, and exported from the region. Its average total height is 85 feet, with about 10 feet of clear trunk. The diameter averages 18 inches, which corresponds to an age of 180 years. In the 812,500 acres of forest area examined 2,743,558,000 feet B. M. of standing timber were found, which gives an average of only 3,377 feet B. M. per acre. It is evident that the yellow pine stands, even where entirely untouched by the ax, do not carry an average crop of more than 40 per cent of the timber they are capable of producing. This condition is chiefly attributable to the numerous fires which have swept over the region within the last two hundred years, destroying seedling and sapling growth.

The chief agencies through which the forests in the reserve suffer destruction are cutting, grazing, and fire. Logging operations have been carried on in most of the central forested areas that are tributary to railroads. The forest has been culled or cut from 148,845 acres. The timber cut on these tracts has been converted into tie, stull or round mining timber, and saw logs.

Grazing, especially sheep herding, is ruinous to the seedling growth of a young forest. Sheep are especially fond of the young aspen, which springs up as the first restockage on the non-forested park lands at the base and on the slopes of the San Francisco Mountains. It was found that the destruction of seedlings on any particular tract of land ranged from 50 per cent to total after a single passage over such ground by 2,000 head of sheep.

Fires have been of frequent occurrence in all portions of the reserve. The badly-burned areas, on which the destruction has been 60 per cent or more, aggregate 6,790 acres. The origin of fires in recent years may, in part, be ascribed to the carelessness of sheep herders, in part to sparks from engines on the Atchison, Topeka & Santa Fe Railroad, but by far the larger number of fires are due to lightning, and this cause has, of course, always operated. Sections exist on which 50 per cent of the mature yellow pine has been either wholly or in part killed by lightning strokes.

Among other interesting questions considered in this paper are the low reproductive ratio of the yellow pine, the influence of the forest on run-off, the grazing value of the reserve, and the effects of sheep herding on the forest floor. The bulk of the paper is devoted to detailed descriptions of the areas, by range and township, that make up the reserve.

LONG-DISTANCE NON-STOP RAILROAD RUNS IN GREAT BRITAIN—A NEW WORLD'S RECORD.

A new record in railroad traveling has been established by the Great Western Railroad, of Great Britain. On July 1 a regular non-stop daily train service was established between the London terminus at Paddington and Plymouth. The distance is 246 miles, and the "Cornishman Limited Express" is scheduled to cover the journey in each direction in 265 minutes without a single stop. This supplies an average speed of 55.69 miles for the journey. This, therefore, constitutes the longest non-stop railroad run in the world.

Ever since the year 1896 this railroad has retained such a non-stop record, for in that year the railroad company initiated a through non-stop train from London to Exeter, 194 miles, covered in 3 hours 45 minutes. During the subsequent years, however, this run has been increased to 3 hours 30 minutes, equal to an average speed of 51.7 miles per hour. In the recently inaugurated run, however, the time between these two points has been still further reduced by five minutes, increasing thereby the average speed to 56.7 miles per hour. Hitherto this railroad has not been able to make the journey a non-stop one beyond Exeter, owing to the absence of the water trough between the tracks from which to replenish the engine's water supply. Now, however, a trough has been laid down at Starcross, between Exeter and Plymouth. Furthermore, the coal capacity of the engine has been considerably increased, and larger lubricating boxes have been supplied, so that the oil boxes can contain a sufficient supply for the entire journey.

Meritorious though this run of 246 miles in 265 minutes is, yet, if the necessity arises, the speed can be considerably accelerated. This fact was demonstrated on May 9 last, with the mail-train run in connection with the North German Lloyd liner Kronprinz Wilhelm. On this occasion the train covered the distance of 246¾ miles from the dock at Plymouth to Paddington in the remarkably short time of 3 hours 46 minutes. The run, however, was not a non-stop, as a mail van was detached and engines changed at Bristol, necessitating a halt of 3 minutes 43 seconds, which stop, however, was included in the time of the run. The average speed on this occasion was 65.49 miles per hour for the whole journey, and the last 36 miles of the run to Paddington was covered at the rate of 79.17 miles per hour. On the occasion of the trial run of the "Cornishman Limited Express," a new record was made between London and Bath, the 107 miles being completed in 102 minutes.

The road, although not so level as that between Camden and Atlantic City, is yet comparatively easy, but after leaving Exeter the road becomes more difficult. Especially so is the last 52 miles into Plymouth, the track abounding in stiff gradients of 1 in 40, with numerous sharp curves, which militate considerably against fast traveling.

There is strenuous friendly rivalry at present existing among the various English railroad companies to establish non-stop records. The London and North-Western Railroad is contemplating the establishment of a through non-stop service between London and Carlisle, a distance of 299¼ miles. They have already made such a run with a "special," which covered the journey in 5 hours 43 minutes, an average speed of 51 miles per hour. With their latest type of engines, however, this railroad company could considerably increase this speed if desired. On the occasion of the Postal Congress at Glasgow last year, the train containing the delegates, and representing a weight of 450 tons, was hauled over the 401½ miles between the two cities, both on the outward and return journeys, without a stop in 6 hours and 6 hours 5 minutes respectively, at average speeds of 66.9 miles and 66 miles per hour.

Already the boat trains running from Liverpool to London in connection with the incoming American mails, three or four times a week, cover the 192 miles in 3 hours 45 minutes, an average speed of 51 miles per hour. Other notable long-distance non-stop runs on this system include Wigan to Willesden, 188½ miles, in 3 hours 41 minutes, average speed 51.1 miles per hour; London to Stockport, 183 miles, in 3 hours 18 minutes, speed 55.4 miles per hour; London to Chester, 179 miles, in 3 hours 33 minutes, speed 50.4 miles per hour.

The Midland Railroad also have inaugurated several noteworthy long non-stop runs. The record is that recently instituted between London and Leeds, 198 miles, in 3 hours 45 minutes; speed, 52.8 miles per hour.

The Great Northern Railroad, which for many years has been considered the crack fast railroad of Great Britain, but which has since lost its reputation in this respect, is also completing arrangements whereby it will be able to regain its lost prestige. Several of the through northern expresses cover the journey every day between Grantham and London, 105 miles, without a stop. Their present longest non-stop run is between Wakefield and London, 175¾ miles, in 3 hours 10 minutes, an average speed of 55.5 miles per hour. Owing to the institution by the Midland Railroad of a through express between London and Leeds, the Great Northern, which also serves the latter town, is instituting a similar service, the 185½ miles to be covered in 195 minutes—an average speed of 57.07 miles per hour.

The Great Northern Railroad also proposes considerable accelerations in connection with the East Coast expresses. For this purpose mammoth powerful engines have been constructed. These are designed by the railroad engineer, are of the compound "Atlantic" class, and represent the limit of the dimensions of a locomotive of the normal type in Great Britain. They have been specially designed to work the East Coast route express trains at a speed varying from 55 to 60 miles per hour, with loads of from 380 to 400 tons behind the tender.

The special feature of this type of engine is the length and circumference of the boiler. The inside diameter of the boiler is 5 feet 6 inches, and the length of the tubes, representing the distance between the smoke-box and the fire-box, 16 feet 3 inches. The heating surface furnished by the tubes aggregates 2,800 square feet, while that of the fire-box supplies about another 200 square feet. The grate area is 32 square feet. The working steam pressure is about 185 pounds per square inch. The two outside cylinders measure 18 inches diameter by 24-inch stroke, and the diameter of the four driving coupled wheels is 6 feet 8 inches. The length of the engine and tender is 58 feet over all, and their combined weight in working order is 110 tons.

SCIENCE NOTES.

A new local anæsthetic of the cocaine order has been discovered. It is called "eucaine," and the advantage of the drug will enable the carrying out of those operations otherwise impossible with chloroform, owing to heart weakness of the patient. It will also enable the surgeon to take more time over his work. Although scarcely adaptable for amputations, it will be useful for treatment of the thyroid glands. The eucaine is injected by means of a hypodermic needle under the skin at the place where the incision is to be made. After a few moments the skin may be cut without the patient feeling anything. As different and independent parts are exposed, the drug is dropped at intervals of a few minutes. A highly successful operation with this anæsthetic was recently carried out in a London hospital, the operation lasting one and a half hours.

The use of an automobile to form a portable station for astronomical work was brought out in a paper recently read before the Académie des Sciences. The work was carried on by Messrs. E. Tronchet and Henri Chrétien, accompanied by the well-known chauffeur Maurice Farman. The report relates to the study of the Leonids in 1903 and the determination of their altitudes by the method of simultaneous observations. The systematic observation of the Leonids was carried on during that year at the Observatory of Chevreuse, with a view of determining the relative position of these bodies with greater precision. To carry this out, the observations were made simultaneously at two different stations situated about 18 miles apart. This distance is large enough so as to make the errors of observation relatively small, and, on the other hand, it is sufficiently short to allow of a sure identification of the meteors which are observed by the double method. The first station was located at the Chevreuse Observatory, whose co-ordinates are: West longitude, 0 deg. 19m. 6s.; N. latitude, 48 deg. 42m. 33s.; altitude, 163 meters. The second station was placed in the Beauce region at Authon la Plaine (co-ordinates 0 deg. 23m. 1s.; 48 deg. 27m. 16s.; altitude, 145 meters). The rectangular distance between the stations measures 28.7 kilometers, and the azimuth of the first, relative to the second, is +10 degrees. As at that time of the year the weather was not generally favorable, in order to make the work easier to carry out the second station was formed by an automobile equipped with the necessary apparatus, which could be driven to the observation point in less than an hour in case of favorable weather. This method of arriving at the spot was all the more appreciated as the radiating point of the Leonids did not rise until very late and the observation had to be made during the latter half of the night. The observations were made on the nights of the 13-14th and 14-15th of November from 1 to 5 o'clock, and were registered on a special chart which was furnished by the Meteor Commission of the Astronomical Society. Chronometers (checked up before and after) gave the exact time. The number of meteors registered was 83 and they appeared to come from four principal radiants. The co-ordinates of these sources are as follows:

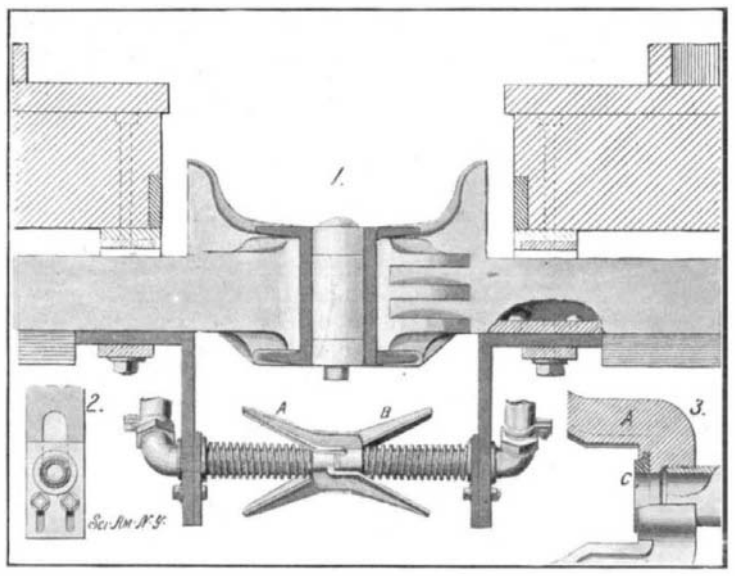
A. R.	D.
137 deg.	+23
75	45
110	32
67	17

The meteors which were observed simultaneously at the two stations were identified by the coincidence of the readings. Out of twenty-two such coincidences, twelve presented sufficient guarantees of exactitude to allow of calculating the altitudes. The report gives the various data for the twelve meteors, together with the altitudes. The mean height of apparition is 103.6 kilometers; that of the disappearance is 75.8 kilometers. The mean length of trajectory is 35.2 kilometers.

Mr. Lyman B. Brainerd, the treasurer of the Hartford Steam Boiler Inspection and Insurance Company, has been elected to the presidency of that corporation to succeed the late J. M. Allen. Mr. Brainerd has had a large experience in the management of corporations, and he will retain his office as treasurer.

AUTOMATIC COUPLING FOR AIR-BRAKE HOSE.

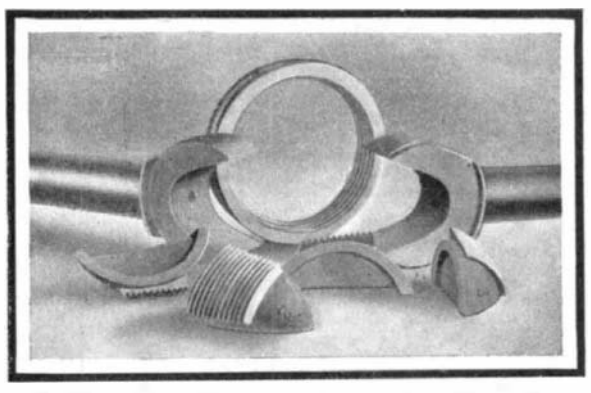
A new form of automatic coupling for the air-brake hose of railway cars has been invented by Messrs. Archibald F. Allen and John A. Lenhoff, of 1906 Scott Street, Wilmington, Del. This coupling is illustrated in the accompanying engraving. Clamped to the ends of the hose are metal elbows, which are supported in hangers depending from the ends of the car platform. Projecting forward from each elbow is a short pipe section, provided at the outer end with the improved type of coupling head. This, it will be observed, consists of a tubular body provided with fingers, indicated at *A* and *B* in the drawing. The fingers of each coupling head are formed with parallel faces, which are slightly concave, to fit closely over the body portion of the opposing coupling head. Beyond this parallel section the fingers diverge, forming an angle of about sixty degrees with each other. In order to hold the pipe sections approximately horizontal when in uncoupled position, they are each provided with a heavy coil spring, which is held under tension between the coupling head and the supporting hanger. When the opposing coupling heads of two cars are brought into engagement with each other, the opposing fingers will ride one upon the other, bringing the coupling heads into perfect alinement with each other. The opposing faces of the coupling heads are provided with rubber gaskets, as shown at *C*, Fig. 3, so that when a coupling is effected, these gaskets will be pressed together under action of the coil springs, and will thus effect an air-tight connection between the coupling heads. This construction will be found sufficiently flexible to allow for all movements of the train; but the coupling heads will be kept in perfect alinement, being held by the broad bearing faces of the fingers. As some cars are considerably higher than others, the construction shown in Fig. 2 is preferably used for supporting the metal elbow. The elbow, instead of being secured directly to the hanger, is fastened to a plate vertically adjustable on this hanger. This permits the coupling section to be raised or lowered any required distance, to bring it into horizontal alinement with the opposing coupling head.



COUPLING FOR AIR-BRAKE HOSE.

AN INGENIOUS ADJUSTABLE UNIVERSAL COUPLING.

One of the greatest difficulties confronting the automobile engineer, especially in those types of vehicles by which the drive is transmitted from the gear to the rear axle through a live axle, is the designing of



The Coupler Dismantled, Showing the Component Parts of the Conical Screw.

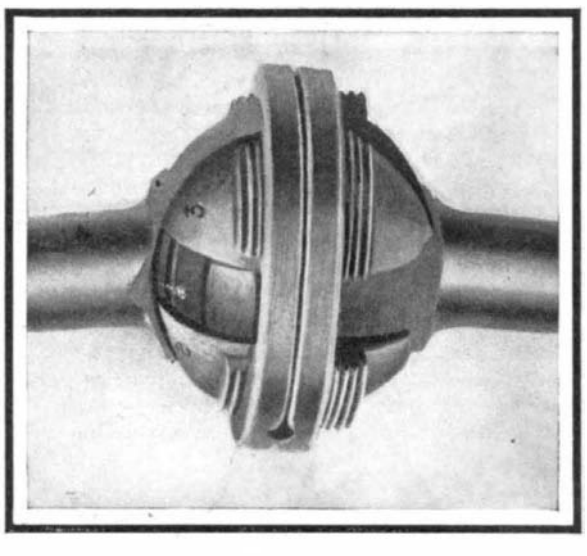
an efficient universal joint or coupling connecting the propeller shaft with the gear and axle. The weakest spot of many cars lies in this section of the mechanism, especially after the car has been in service for a short time, as considerable stress and strain are encountered at this point. Especially is this the case with those varieties of universal couplings in which there is no provision for making any adjustment to take up the wear. The consequence is that when the joints become slack, they cannot be tightened up, and the parts have to be renewed.

This is a serious disadvantage, since, owing to the fact that these couplings invariably work in exposed positions and are not protected from dust and grit, they are liable to wear loose, rattle, and finally, in many cases, break down altogether.

To overcome these deficiencies an ingenious universal coupling has been devised by Mr. W. Newman, A.M.I.M.E., of Totteridge Park, Herts, England. The most distinctive feature of this mechanism is that by means of a simple arrangement the working parts of the joint are rendered adjustable, the effect of which is that the results of wear can be neutralized and the joint can always be kept adjusted to a nicety.

The principle of the design of this apparatus can be realized from our first illustration showing the joint dismantled. The ends of the two shafts are forked and to the sides of these forks are fitted four segmental blocks. A conical screw is cut on the outer surface of each of these blocks, and on this cone is screwed a ring binding the four segmental blocks and forks into one joint. If the screw is screwed right home on the cone, all the blocks are forced in evenly toward the center, thus tightening up the joint. If the ring is unscrewed, the joint is slackened. After the ring has been suitably adjusted in this manner it is locked into position.

The advantage of this mechanism is greater strength over the system involving the ordinary forks pierced with bolts, and durability. Moreover, if necessary, and especially when employed in conjunction with large shafts, it can be tightened up so as to drive as a practically solid shaft and yet yield immediately to any bending stress. The same system, again, with but a slight deviation in the general design, can be applied for coupling the engine to the gear or for connecting any two pieces of shafting together.



THE ADJUSTABLE UNIVERSAL JOINT COMPLETE.

Trackless Railway in Prussia.

A trackless railway is being erected by the community of Mannheim, which will be the first of its kind in Prussia. It will run from Mannheim to Langenfeld and will be about 2½ miles long, with two short branches intended for freighting purposes.

The main line will serve for the transportation of persons, baggage, mail, and freight. An extension is possible at both ends. The roadway from Mannheim to Langenfield is 23 feet wide, with a good basaltic cover about 15 feet in width, running almost in an air line, with the exception of a few curves. A special contrivance for coupling is provided in order to keep the cars exactly in line; this takes the place of wheel flanges in ordinary rail trains. The buildings to be erected for use of the railway are a power house, car barns, repair shop, and offices. For the running of the railway a current of about 550 volts will be furnished. The power will be conducted to and from the cars, which are provided with electric motors, by means of two revolvable poles, placed on the top of the cars, and sliding blocks enabling the train to move sideways from 10 to 12 feet.

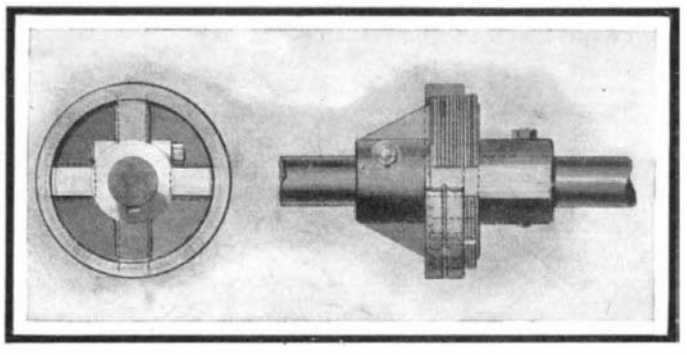
The wiring will consist of two hard copper wires, with hard rubber insulators, carried by iron poles about 18 feet above the middle of the road. For entering farmyards lying close to the road there will be used, instead of the regular wire, a connector and flexible cable 50 to 70 feet in length, by means of which the current will be transmitted to the motor car. Ordinary electric cars have but one pole, and the second pole of these railless cars serves for conducting back the current, which is otherwise done through the rails.

When these trains pass each other, one will remain standing under the wires and disconnect its current until the other has passed. The trains will consist of an electric locomotive for drawing two or three cars, driven by two electric motors of from 25 to 40 horsepower, and will be furnished with the necessary illuminating apparatus and brakes. The conducting crew has its place on the locomotive. The cars for carrying freight have a capacity of about 5 tons. These cars will be coupled in such a manner that the wheels of the car following run alongside the rut of the forward one, thus making a wide rut and avoiding the damaging of the road on wet days. Some of the cars will be open and some closed, and all will be fitted with the necessary brakes. Farmers' wagons can be attached to the end of the train, requiring only that the ordinary tongues of the wagons be replaced by shorter coupling tongues.

For the passenger service a motor omnibus, having a seating capacity of sixteen and standing room for eight, is provided. In case of an increased passenger traffic a similar car, but of lighter construction than the motor omnibus, will be added. Five or six double trips at the rate of 8 to 10 miles per hour will be made daily on schedule time. For the accommodation of the workingmen, in the morning and evening, two labor trains consisting of motor car and one or two passenger cars will be added. Freight will be carried on week days only, as conditions may require, and during the intervals between passenger trains. The fare for the entire trip will be 6 cents. For carrying freight the charge will be $2.38 per carload of 10 tons. Subscribers and parties doing a large freight business will be allowed a discount.

Motor Mail Cars in Germany.

The Bavarian ministry of transportation has recently issued tenders to a large number of firms for the supply of railroad motor cars. For main roads two sizes of motor cars are proposed to be built, and for branch roads one size—however, in two patterns of different capacity. The large motor cars for branch roads are required to pull a trailer of 2 tons, and the smaller ones each about three-quarters of a ton to 1 ton gross weight. The large cars are intended to accommodate the entire passenger, mail, and freight service on small local roads, while the smaller cars are to be used on roads where a separate passenger and freight service may economically be maintained. On these lines the motor cars are to serve for the transportation of passengers' baggage, and possibly also for the transportation of a limited number of passengers, while the freight and regular parcel-post service will be maintained by local trains. All motor cars for main and branch roads will only have one class of passenger accommodation, similar to the third class on regular German railroad trains (wooden unupholstered seats), but the same will also have a special compartment for passengers with heavy baggage, or to be used for standing room in event of emergency during extraordinary rush of passengers.



Section and Partial Side Elevation, Showing the Application of the Joint for Coupling the Motor to the Transmission Gear of an Automobile.

The extreme speed per hour of the large cars (without trailer) is to be 46.6 miles; of the small cars, 37.3 miles; and on branch roads, 31 miles.

The first of the new type of battleships for the British navy has been launched at Pembroke. This warship is a combination of the battleship and cruiser, possessing the most prominent features of each, being larger and more heavily armed than the cruiser of the latest design, and resembling the battleship in many respects. The armament is particularly formidable, comprising six 9.2-inch guns, ten 6-inch, and twenty-eight smaller quick-firing weapons. There are three submerged torpedo tubes. The main armament is carried in a citadel amidships. Under all the 6-inch guns are small auxiliary magazines and shell rooms. The maximum speed is to be 22.33 knots per hour. The battleship cruiser, as it is called, will cost $5,659,410 to complete.

THE BRITISH FIREMAN'S MASK AND SMOKE JACKET.

BY W. G. FITZGERALD.

The Metropolitan Fire Brigade of London now have among their outfit, not only at the Southwark headquarters on the south side of the Thames, but also at all the leading sub-stations, a number of ingeniously contrived apparatus which are something more than mere masks enabling the firemen to enter smoky buildings, being regular jackets and masks combined, and the wearer being supplied with fresh air by means of pumps, precisely as though he were a diver entering the depths of the sea.

The utility of this apparatus was very fully demonstrated a few weeks back, when a great and destructive fire broke out at a large chemical works on the eastern outskirts of London, the smoke from the burning material being dense, deadly, and poisonous in the extreme.

These apparatus, or at any rate, the more elaborate of them, are made by regular diving engineers.

Foremost among these apparatus comes the Fleuss dress, which is more especially designed to enable miners and mine officials to enter pits and shafts after a disastrous explosion of coal dust or fire damp, when it would mean certain death for any one to attempt to respire the poisoned air. It is not too much to say that hundreds of lives have been saved by means of the Fleuss apparatus.

Then, too, in most of the big refrigerating works in England, these jackets and masks are kept handy, much as fire-extinguishing apparatus are kept, so that in the event of any accident happening in the ammonia chambers, the rescuers may venture in with perfect safety to themselves, and effect the work of rescue.

The London firemen are thoroughly well versed in the use of these jackets and masks, and in considerable fires where their use is necessary, they are taken on the engine in sets of two or four together with the necessary air pumps, which supply pure air to the communicating pipes.

Of course the fireman so accoutered has to be very careful in making his way not to get his air pipes entangled. There are other apparatus of somewhat similar kind, however, which do not need to be supplied by outside air pumps, but have a system whereby the respired air is purified and the necessary elements added to it, so that it can be breathed over again.

Another class of London public servants who understand the use of this invaluable apparatus are the men who work in the great sewers of London. It happens by no means infrequently that a party of three or four men taking their way through the main sewers, jack-booted and up past their knees in water, suddenly encounter an accumulation of mephitic gas.

A FIREMAN CLAD IN A PROTECTIVE SUIT, TO WHICH AIR IS SUPPLIED.

Probably one or two of them may contrive to escape, leaving their companion or companions unconscious in the water or in the flat-bottomed boat which is sometimes used in the great sewers of London. Forthwith a rescue party is organized, and the Fleuss apparatus or another of the same kind is brought into requisition, with the result that the men overcome are without difficulty brought safely to the bottom of the manhole, and then raised without difficulty to the street surface.

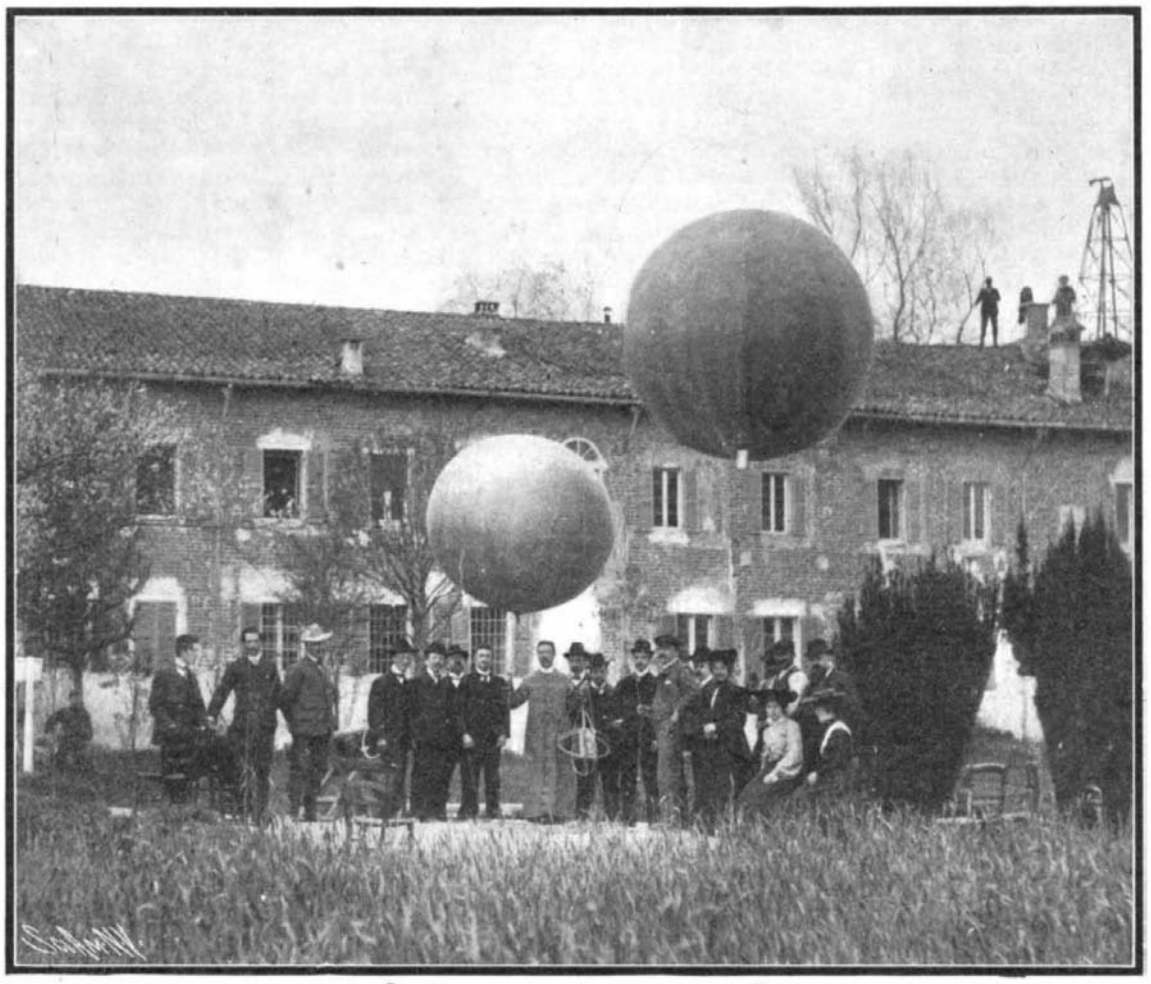
These curious "diving dresses," as they may be called, since they enable the wearer to breathe in an otherwise impossible element, are often carried on board British warships, so that in the event of explosion, or similar accident, rescues can be effected before men unconscious or wounded can be wholly suffocated by smoke or gas.

The masks and jackets may also be found in such establishments as the great government powder mills at Waltham Abbey, particularly in the department where the secret explosive cordite is manufactured out of gun-cotton. Many a rescue has been effected by the aid of this apparatus after a serious explosion in the incorporating mills, or the semi-subterranean cavernous structures in which the various nitro-compounds are handled.

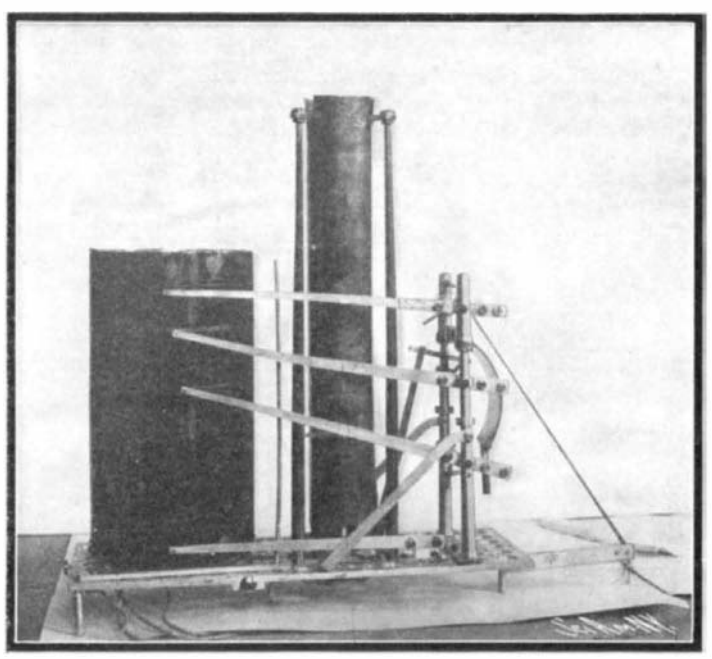
REGISTRATION BALLOONS IN ITALY.

Europe has recently taken the initiative in the use of balloons for fathoming the mystery of certain phenomena of the physics of the globe. An international commission with headquarters at Strasburg has been formed under the presidency of Prof. H. Hergasell.

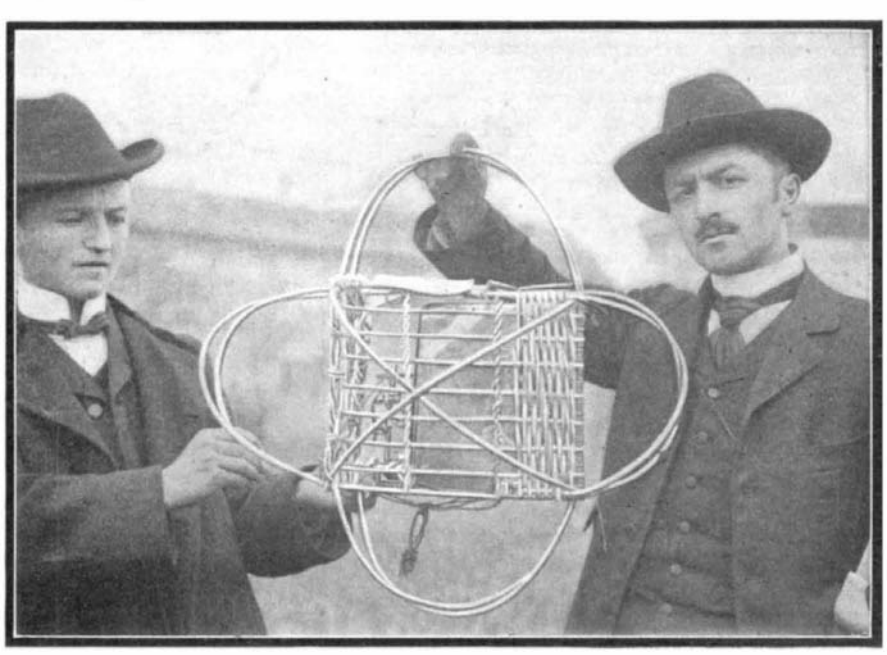
It is proposed to send up registration balloons to different altitudes during each month with a view to establishing the laws relative to the variation, with the height of the pressure, humidity, and temperature. The idea is, generally speaking, to collect once a month data that shall permit of constructing, so to speak, a map with horizontal curves of the thermic, barometric, and hygrometric states of the atmospheric ocean on a given day by figuring alongside of the isobars at the sea (isotherms, etc.), the isobars at 5,000 meters (16,405 feet), and, if possible, at 1,000 meters (3,281 feet), etc., by making use of the data afforded by the balloons and of those furnished by mountain observatories.



The Balloons Before the Ascension.



Psychrometric, Thermometric, and Barometric Apparatus



Registering Apparatus.

REGISTRATION BALLOONS IN ITALY.

The *modus operandi* is as follows: The observatory directors have to study the registering apparatus before and after the ascension, and see that the ascension is properly made. As soon as a telegram is received announcing the place where the balloon has fallen, the director proceeds thither, takes notes as to the descent, and removes the balloon and apparatus. Upon returning to the observatory, he fixes the diagram with gum-lac dissolved in alcohol, makes a detailed report upon the meteorological conditions previous to and during the ascent, and sends the whole to Prof. Hergasell, superintendent of the Meteorological Institute of Strasburg. At Strasburg the various diagrams obtained at the different aeronautic stations are studied and the results thereof coordinated. The material is afterward published in a special organ entitled "Veröffentlichungen der internationalen Kommission für wissenschaftliche Luftschiffahrt."

The balloons employed are double, i. e., they consist of an upper bag 6½ feet in diameter, inflated with hydrogen to a tension so calculated as to cause it to burst when it reaches an altitude of 12 or 18 miles. The lower bag, on the contrary, is much less inflated, and is simply designed to act as a parachute when the other bursts. It carries the car and the exploring instruments, viz.: a thermometer, a barometer, and a hydrometer. These apparatus, through a clockwork movement, register different lines upon a revolving drum coated with lampblack.

In Italy, the first experiments were made on March 3 and April 14, 1904, and were directed by Prof. Camillo Alessandri, superintendent of the Meteorological and Geodynamical Observatory of Paris. This place was selected as the Italian station for sending up registration balloons because it is situated in the immense plain of the Po, far from mountains and the sea.

On the 3d of March the weather was so bad that it was impossible to take any other photograph than the one representing the members of the commission. On the contrary, we are indebted to the courtesy of Prof. Alessandri for a series of views of the ascension of April 14, two of which represent different phases thereof. Another represents the car with the registering apparatus, and another still the psychrometer, the thermometer, and the barometer tracing curves upon a cylinder coated with lampblack, along with the diagram of April 14.

The ascension of the 14th gave a very good diagram of the pressure. The minimum ordinate corresponds to a pressure of 82 millimeters (3.228 inches) of mercury in ordinary weather. The curve of the humidity (the highest of the three) is also very characteristic. The pen of the thermograph unfortunately ceased to operate at about two-thirds of the altitude. It takes the cylinder one hour to make an entire revolution. It is therefore impossible to introduce into the barometric indications the desired correction of temperature, and, consequently, to say what was the maximum altitude reached by the balloon, and what was the lowest temperature. This, however, is of but relative importance.

The experiment of March 3, on the contrary, reveals a new fact, and that is that, contrary to what has hitherto been thought, the temperature above 12 miles altitude appears to remain constant. This first result, should it be confirmed, will well inaugurate the series of experiments directed by Prof. Alessandri, from whom there is much to be expected in this matter, since it is under his direction, also, that is being built, at 14,092 feet above sea level, the observatory of Monte Rosa, which will be the highest one in Europe, and perhaps in the world.

SIR WILLIAM RAMSAY.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The eminent English scientist, Sir William Ramsay, whose name is so intimately associated with the new element radium, is a born chemist. He has always lived and moved in a scientific atmosphere. His grandfather was a large manufacturing chemist; his father was also intimately connected with the science, though he practised as a civil engineer, while his mother's father and brothers were all physicians and chemists.

Sir William Ramsay is one of the world's youngest scientists, being only fifty-two years of age. He is a Scotsman by descent and was born in Glasgow in 1852. His uncle, who was a sugar planter, when he died left his library to young Ramsay's father. This library contained a selection of books on chemistry, one of which exercised a peculiar fascination for the youth. This was "Graham's Chemistry," which Sir William says he "read with great eagerness while he was a youngster," and which he describes as "clear and interesting as a novel." Curiously enough, some years later this scientist stepped into the shoes, as it were, of the master who had been his inspiration—professor of chemistry at London University College, an appointment formerly filled by Prof. Graham.

Sir William Ramsay received his primary education at the Glasgow Academy. From this he passed to the Glasgow University. When the time arrived for him to select his profession he decided to adopt medicine, and entered the laboratory of an analyst to gain his elementary knowledge. His spare time he devoted to attending lectures on chemistry at the University, and particularly patronized the lectures of Lord Kelvin, in whose class he secured the third prize.

At nineteen years of age he left Glasgow and went to Tübingen University, where he remained two and a half years and eventually secured his degree. He was twenty-one years old when he returned to England and became assistant to the technical chair of chemistry at the Andersonian University, which post he occupied for two years.

In 1874 he was appointed tutorial assistant in chemistry at the Glasgow University. This office he filled for six years, vacating it only to succeed to the professorship of University College at Bristol. At the time of his appointment Prof. Marshall, the eminent political economist, was principal of the college, but Sir William Ramsay had only been with him a year when he resigned, and the professor of chemistry became the principal of the college in his place.

This period was one of the most arduous in the life of Sir William Ramsay. He not only filled the principal's chair and carried out those official duties, but he continued his chemistry lectures as well, and filled the dual office for some six years. In 1887 the chair of chemistry at the University College, London, fell vacant, and Sir William Ramsay was appointed to the office, a position which he accepted, and forthwith resigned his Bristol appointments.

Sir William Ramsay may be said to have first brought himself to the public notice by his brilliant discoveries of unknown and unsuspected constituents of the atmosphere—discoveries made partly with the collaboration of Lord Rayleigh. As a reward for their labors these two scientists were awarded the Hodgkins prize of the Smithsonian Institution of $10,000.

Valuable though these discoveries were, they had merely brought Sir William Ramsay to the threshold of still greater possibilities. In the spring of 1895 his attention was drawn to the experiments of Dr. Hillebrand, an American chemist who had succeeded in deriving a new gas from certain minerals. The features of this gas caused the discoverer to advance the theory that the minerals from which he had prepared this gas were the constituents of argon.

Sir William Ramsay followed up Dr. Hillebrand's investigations and procured a quantity of these minerals. He heated them, and eclipsed his previous effort by obtaining helium. The characteristic line of this gas had been found in the solar spectrum by the French astronomer Janssen as far back as 1868, and had been designated helium by Profs. Frankland and Lockyer. Sir William Ramsay, however, was the first scientist to obtain it.

In 1897 in the course of an address before the chemical section of the British Association for the Advancement of Science at Toronto, Sir William Ramsay further stated that there were three other gases which had so far resisted discovery. Furthermore, he was so bold as to describe some of their most salient characteristics. This was a bold assertion to make, even for an expert chemist, and Sir William Ramsay must have been exceptionally confident of deriving them. Such a feat of prophesy has only once before been equaled. This was by Prof. Mendeljeff of St. Petersburg, the enunciator of the law of periodicity. The three gases which Sir William Ramsay so described before their actual discovery, were neon, krypton, and xenon.

In five years Sir William Ramsay had discovered no less than five new elements in the air—a remarkable achievement, the value of which may be more comprehensively gaged from the fact that from 1863 to 1875, a period of twelve years, only two elements had been discovered—indium in the former year and gallium in the latter.

At the present moment the scientific world is still busily occupied studying the results of Prof. Ramsay's experiments with radium, and the transmutation of metals. Prof. Rutherford and Mr. Soddy, of Montreal, suggested that it was not improbable that one of the products of decomposition of the emanation from radium salts would prove to be helium. Sir William Ramsay, in concert with these scientists, set to work to substantiate the theory, and undoubted spectroscopic evidence was obtained that helium is a product of the disintegration of the emanation.

This discovery was obtained in a peculiar manner. Mr. Soddy observed that the gas emanating from a compound of radium was not affected in any way by any chemical reagent, and that it is self-luminous. Prof. Rutherford and Mr. Soddy concluded from this fact that it was perpetually transforming, and that the luminosity was due to the parting of electrons in changing its condition. From this it was surmised that it changed into something, but the question was, What? Sir William Ramsay came to the rescue. He collected the gas of radium and subjected it to spectroscopic inspection. It was found to be peculiar. Two days later it was again examined and the spectrum of helium was observed, growing brighter and brighter as the spectrum of the gas decreased in distinctness. Ten days afterward the evolution was so far advanced that the material into which the luminous gas had changed was found. This discovery is momentous in its value; for does it not mark a new turning point in applied chemistry? At any rate, it must have been a source of peculiar satisfaction to Sir William Ramsay to discover that radium was emitting his own discovery, helium.

Sir William Ramsay is a most skillful mechanician. As he invariably works with such infinitesimal quantities, the experiments necessitate the employment of delicate and special apparatus. All this Sir William makes himself, as it would take too long to inculcate another workman as to his requisitions. He has even devised a new method of glass blowing in order to obtain the special minute vessels he requires for his researches. Some idea of the small quantities of material with which this distinguished scientist works may be gleaned from the fact that in some of his recent radium investigations, Sir William was using less than a cubic millimeter of gas, a quantity which could be placed in less space than a pin's head. This accumulation was the result of two months' work, from which one can estimate the rarity of radium.

Few men have received more decorations than Sir William Ramsay in recognition of their scientific achievements. That rare award, the Hoffman foundation gold medal, which is bestowed only once in five years upon a foreigner, was presented to him for "distinguished work in the field of general chemistry, particularly for the discovery of new ingredients in the air." This medal was instituted in 1888 and is called after the celebrated German chemist of whom, curiously enough, Sir William Ramsay was formerly a pupil. The English scientist was the first man to whom the medal was presented.

He is also an officer of the Legion of Honor, and a corresponding member of the Institute of France. He is furthermore an honorary member of all the leading scientific associations both in Europe and this country.

He has contributed numerous scientific papers dealing with his discoveries and their influence upon present scientific knowledge. The most important of these publications are those dealing with "The Molecular Surface-Energy of Liquids"; "Argon, a New Constituent of the Atmosphere," written in conjunction with his collaborator in this discovery, Lord Rayleigh; "Helium a Constituent of Certain Minerals"; "Neon, Krypton, and Xenon, Three New Atmospheric Gases"; and more recently several papers concerning the phenomena of radium. He is also the author of two text books on chemistry, as well as "The Discovery of the Constituents of the Air."

Although he is a busy worker, Sir William Ramsay yet finds time to indulge in his recreations, which comprise cycling, the study of languages, and mountaineering. He is also a great lover of music, and is an accomplished player upon the violin.

A New Satellite of Saturn.

In 1899 Prof. William H. Pickering, from an examination of photographs taken for the purpose with the 24-inch Bruce telescope, discovered a new and faint satellite of Saturn, having a period of about a year and a half. (See H. C. O. Circular No. 43.) A further discussion of a large number of photographs has served to determine the elements of its orbit. Eleven photographs taken by Mr. Frost at the Arequipa station, under the direction of Prof. Bailey, enable us to follow the satellite from April 16 to June 9, 1904, and to correct its ephemeris. A full discussion by Prof. Pickering will appear in a few weeks in a forthcoming volume of the Annals. Meanwhile, to enable astronomers elsewhere to observe it at once, its position, angle, and distance from Saturn may be stated to be on July 14, 77.4 deg. and 17.8 min.; on July 24, 79.8 deg. and 14.3 min.; and on August 3, 1904, 84.0 deg. and 10.5 min., respectively. EDWARD C. PICKERING.

The Current Supplement.

"Steel Making at Ensley, Alabama," is the title of the article which opens the current SUPPLEMENT, No. 1490. Excellent illustrations accompany the text. An article on the origin of radium explains in a popular way the elementary philosophy of radio-activity. Some interesting experiments in forcing plants by ether are described by the Belgian correspondent of the SCIENTIFIC AMERICAN. Messrs. C. E. Stromeyer and W. B. Baron conclude their discussion of water-softening apparatus. "Fertilizer from Fish Waste or Refuse" is the title of a most instructive article by C. H. Stevenson. Of archeological interest is an essay by Harlan I. Smith on a costumed human figure from Tampico, Washington. Many illustrations accompany this article. Emile Guarini, who has made a special study of the use of electricity in agriculture, was commissioned to deliver a course of lectures on electroculture by the Minister of Agriculture of Belgium. An abstract of

his lecture is given. "The Recent Progress of Tanning as a Chemical Industry" is made the subject of an exhaustive paper by J. T. Wood. The first series of articles by the Paris correspondent of the SCIENTIFIC AMERICAN on the cars in the Gordon Bennett Cup Race is published. Some extracts from a paper by J. Campbell Morrison on peat as a fuel may be found of value to those who are at all interested in fuels. The usual science notes, electrical notes, and consular notes will also be found in the SUPPLEMENT.

Electrical Notes.

An amalgamation of the patents of the De Forest and Maskelyne wireless telegraph systems has been effected. The object of this combination is to employ wireless telegraphy as a feeder to cable telegraphic systems. Indisputably there are numerous opportunities for the operation of either communication in the capacity as a feeder to cables, and over short distances. In co-operation with the cable companies, it is proposed to link isolated islands with the nearest cable stations, and to develop wireless communication between ships and shore, and between vessels at sea. This combination will strengthen both systems. As is well known, the De Forest apparatus is a sound recorder, the messages being received on the principle of a telephone, while on the other hand the Maskelyne system is a tape recorder. By this amalgamation, therefore, either system will be available according to requirements

At a recent meeting of the Elektrotechnischer Verein, Berlin, Dr. Reichel, chief engineer to the Siemens-Schuckert Werke, read a paper on the Berlin-Zossen experiments. In connection with the difficulties attendant on the transmission of electric energy to large railway systems, Dr. Reichel referred to the work done by the Siemens & Halske Company and the Siemens & Schuckert Werke. Experiments with high-tension alternating current for the operation of electric railways were begun as far back as in 1897, on a suggestion by Mr. Wilhelm von Siemens, with a view to ascertaining the working conditions of high-speed electric railways. Provided a means be found to transmit amounts of energy as high as 2,000 to 3,000 kilowatts to rapidly-moving cars, the problem may be solved in any special case. The Gross-Lichterfelde experiments, undertaken with this view, afforded a basis for the well-known Marienfelde-Zossen experiments, commenced immediately afterward (in 1900). As a transmission of a high-tension current to the car did not offer any unsurmountable difficulties, endeavors were eventually made to use not only three-phase but also single-phase alternating current for the operation of railways. As regards the respective advantages of single-phase alternating and continuous currents, Dr. Reichel thinks the conditions of each special plant to be the only means of realizing these. He accordingly does not deem it advisable wholly to abandon continuous-current operation, the more so as material improvements, especially with respect to the increase of tension, are possible on these lines also, while many years' experience will, on the other hand, be necessary to fully realize the properties of single-phase alternating-current operation. The best means of securing this experience would be, according to Dr. Reichel, to install some electric railway systems using this novel kind of current.

The electric weld is becoming a more and more important factor in many industries. During recent years the extension of its application has been steady, and each year has witnessed its entrance into new fields. Sometimes, indeed, new manufactures, or new ways of obtaining results, have been based upon its use. The electric welds under consideration are the results of the operation of uniting two pieces of metal by what is known as the Thomson process, first brought out by the writer and rendered available in commercial practice a considerable number of years ago. The rapidity, flexibility, cleanliness, neatness, accuracy, and economy of the electric process has won for it such an important standing in the arts that many future extensions in its application are assured. The uniformity of the work, the control of the operation, the extreme localization of the heat to the particular parts to be united, and the fact that the process is not limited to iron and steel, but can deal equally well with other metals, such as copper, brass, bronzes, and even lead, are characteristics of the electric welding operation. In the wagon and carriage industry the process is applied in the production of tires of all sections, axles, hub, spoke and sand bands, fifth wheels, shifting rails, steps, shaft iron, etc., while it has found a large use in the welding into continuous strips or bands of the wires inclosed in rubber tires for holding them in place. The larger part of the dash-frames used in carriages in the United States are now probably made by electric welding, while iron and steel agricultural wheels are built up, or have their parts united, by electric welds. To enumerate the many applications to the bicycle industry would be almost to catalogue most of the metal parts of this useful machine. It must be borne in mind, too, that a welding machine, slightly modified, is equally applicable for locally heating parts in electric brazing or hard soldering, for upsetting, and for bending or shaping. In the wire industry the part played by electric welding is already quite important, and becomes steadily more so. Besides the mere simple joining of wires of iron, steel, or copper into long lengths, the welding of wire or strip into hoops for barrels, tubs, pails, etc., is supplanting the older forms. Numerous machines are in operation turning out electrically-welded wire fence, much as a loom turns out cloth.—Elihu Thomson, in Cassier's Magazine.

Rapid Coaling of Warships in Port.

The British Admiralty are endeavoring to expedite the coaling of warships while in port. It is imperative in case of hostilities, when a warship has to return to its naval base for fresh fuel supply, that such replenishment should be carried out as rapidly as possible, in order to permit the vessel to return to the scene of operations, or proceed on its journey. For this purpose the navy department is acquiring special floating coal depots of different types and dimensions, adaptable to various ranges of operations.

The latest type of this floating coal reservoir has been delivered to the dockyard at Portsmouth. It has been constructed by Messrs. Swan, Hunter & Co., of Wallsend-on-Tyne, and is of huge dimensions. The depot is constructed for carrying 12,000 tons of coal, and is sufficiently large to enable two first-class battleships or four smaller vessels to be berthed alongside and coaled simultaneously. The actual coaling operation is accomplished by means of Temperley transporters, three of which are erected upon each of four platforms with which the depot is provided. The depot will be moored at a suitable place in the harbor. Its advantage over projecting piers is that it can be towed to any desired position whenever required. With this type of coaling reservoir the fuel will be transported to the bunkers of the war vessels with much greater celerity and ease than is at present possible.

Another type of coaling device which has proved highly successful is what is known as the "haulabout." These haulabouts are plain steel hulls, similar to barges, with hatchways extending nearly across the vessel. Fitted to each haulabout are two self-contained Temperley traveling tower transporters, the beams of which have a very long over-reach on either side, and are sufficiently high to take coal from a large collier, and deliver it directly to the boat deck of the largest battleships or cruisers, if necessary. For the purposes of transshipping the coal from the colliers to the hold of the haulabout, the towers are made to travel the full length of the vessel. Thus they command the full extent of the hull of the barge both in filling and discharging. The capacity of a haulabout is 1,000 tons of coal.

Each tower of the transporter is fitted with a steam boiler and special engine for hoisting and conveying the load, for raising and lowering the overhanging parts of the beam, and for propelling the tower along the rails. This engine is also fitted with gearing and lifting tackle for removing and replacing the hatch covers, which are picked up and carried to the end of the vessel by traveling the towers along in the usual way.

These haulabouts have been specially designed to provide a coaling vessel of considerable storage capacity, capable of being hauled about from vessel to vessel, where it can either supply coal from its own hold, or be used for discharging coal direct from the collier to the vessel to be coaled. The vessels are capable of filling their own holds, either from colliers or from the shore, for which purpose they are supplied with automatic dumping buckets.

Pyro Rays Given Off by Incandescent Wires.

M. Tommasina has been making a series of researches upon the radio-activity which is produced by incandescent wires, and brings out some phenomena of a novel character. He finds that the wire gives off three different kinds of rays. The observations were made upon the loss of electric charge produced by a metallic wire heated to redness by a current and placed parallel to the metal disk of an electroscope or between the two plates of a condenser. In the latter case one plate is connected to ground, and the other to the electroscope. Under these conditions he observes various phenomena of loss of electric charge, and these can only be attributed to a radio-activity which is induced by the emanation from the incandescent wire. In observing the nature of these emanations he finds three kinds of rays which he designates as α, β, and γ, and calls the phenomenon "pyro-radio-activity." In the case of the α rays, the emission is stopped by even the thinnest screen of any kind of material. In free air it seems to diffuse, with a strongly-marked tendency to follow the lines of electric force. It transports a positive charge. The β rays will traverse a very thin screen of paper or aluminium (which absorbs the greater part, however) and they carry a negative charge. These forms of radiation, which he calls "pyro-rays," cause a strong ionization of the air. They produce the discharge of an electroscope no matter what may be the sign of its charge, and will traverse a hermetically-closed recipient of cardboard. In the latter case their action is diminished, however. They will also produce an induced fluorescence of a platinocyanide of barium screen, to a slight degree. The pyro-rays are given off in great quantity from an incandescent platinum wire and also by a disruptive discharge between any metallic wires.

Automobile Notes.

The report of the motorcycle endurance test held July 2 to 7, and consisting of a round trip run from New York to Albany and back, followed by a run to Cambridge, Md., has just been made. An average speed of 15 miles an hour was easily maintained. The miniature automobiles made an excellent showing. The five machines that scored the best in the complete test were 1¾-horse-power "Indians," which had respectively 1,317, 1,310, 1,309, 1,308, and 1,306 points to their credit. Their nearest competitors were a 1¾-horse-power "Rambler" (1,296 points), and two 2¼-horse-power "Columbias" (1,295 and 1,292 points respectively). Besides the road endurance tests, a gasoline consumption test was held, in which a Yale-California machine covered 55 miles on one quart of fuel at a cost of about a mill a mile. The tests have thus thoroughly demonstrated the practicability, utility, and cheapness of the American motor bicycle.

The New York-St. Louis Automobile Run, under the auspices of the American Automobile Association, will start from this city Monday, July 25. The cars are expected to arrive at the World's Fair on August 10 and join in the parade which will be held the following day, which is to be "Automobile Day" at the fair. At least 100 machines will in all probability start from New York. These will be joined by others throughout the tour, and it is expected that fully 200 cars will enter St. Louis on the appointed day. A fee of $10 is charged for joining the run, and certificates will be given all cars that successfully complete it.

The greatest hill-climbing contest that has ever been held was that up Mount Washington, which took place Monday and Tuesday of last week. Some attempts at mountain climbing have been made abroad by following the roadbed of cogwheel railways, but no real mountain climbing contest over a road eight miles in length, with a continuous grade of from 5 to 20 per cent, has ever before been held. Some eighteen machines participated in the climb. The most sensational as well as the fastest performance was that of Harry Harkness on his 60-horse-power Mercedes, which conquered the mountain in 24 minutes, 37 3-5 seconds. F. E. Stanley, one of the pioneer inventors of the steam automobile in America, made the next best time in a 6-horse-power steamer. This was 28 minutes, 19 2-5 seconds. A 2-horse-power Metz motor bicycle covered the distance in the excellent time of 34 minutes, 11 3-5 seconds. The best performances in the class for vehicles weighing between 1,000 and 2,000 pounds were those of a 24-horse-power Peerless (26 minutes, 6 4-5 seconds, 2 minutes being allowed on account of a delay caused by another machine being in the way); a 10-horse-power White steamer (42 minutes, 19 4-5 seconds); and a 20-horse-power, 3-cylinder Phelps (47 minutes, 20 2-5 seconds). A 12-horse-power Columbia machine did the climb in 51 minutes, 50 2-5 seconds, while a 16-horse-power Rambler dropped out with a broken transmission. For vehicles under 1,000 pounds, a 6-horse-power Oldsmobile made the very good time of 1 hour, 20 minutes, 46 seconds. Two specially-built light steam cars were second and third in this class in 2 hours, 16 minutes, 55 seconds, and 2 hours, 25 minutes, 51 2-5 seconds respectively. In the free for all class, Mr. James L. Breeze, in a 40-horse-power Mercedes, climbed the mountain in 31 minutes, 22 4-5 seconds; and Otto Nestman, in a 7-horse-power Stevens-Duryea, in 40 minutes, 45 seconds. What made the test of particular value was that the machines were all stock cars. Besides the mountain-climbing contest, several 100-mile tours through the mountains were made during the remaining days of the week.

A new form of endurance test that has developed of late is the non-stop run. By this is meant a trip during which the engine of the automobile is never stopped. The longest run on record of this kind is one of 2,017 miles, made recently in England on a Talbot car. The run consumed 5 days and 4 hours, during all of which time the engine ran continuously. Several attempts of this sort have been made in this country, but so far they have not been successful.

A queer order has been placed with a firm of Sheffield (England) manufacturers by an Oriental potentate for the supply of a bedroom suite made throughout of solid silver. The designs are of Oriental character, and most elaborate. The suite comprises a bedstead, cabinet, dressing table, one dozen chairs, three foot-baths, and three hot-water cans.

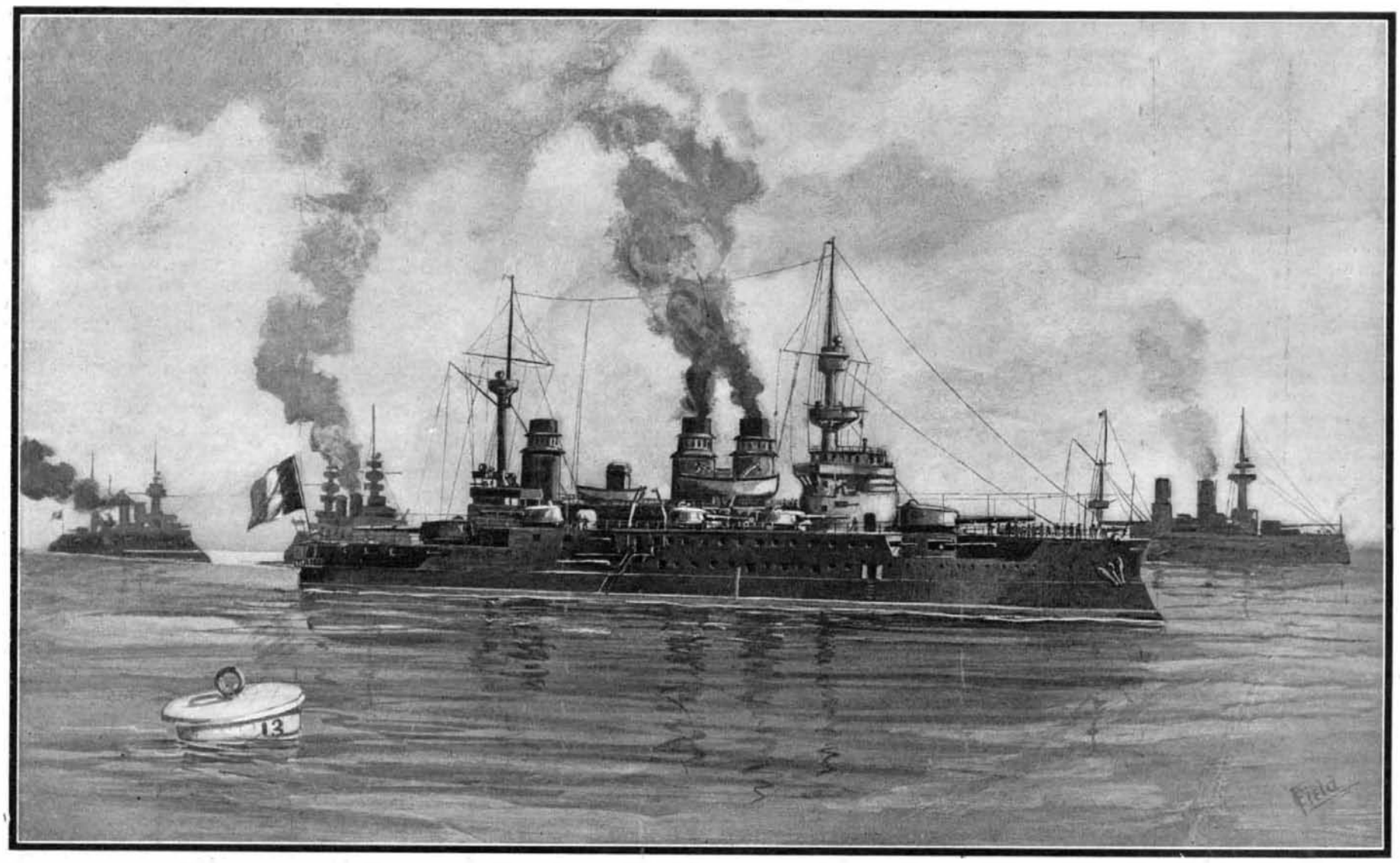
THE NEW FRENCH BATTLESHIP "DEMOCRATIE."

BY LIEUTENANT-COLONEL C. FIELD, GLASGOW.

The fine French battleship "Democratie," which was put upon the stocks at Brest in the course of last year, was very recently launched in the presence of a large and enthusiastic crowd of spectators. The displacement of the new war vessel is 14,800 tons, and the weight of her armor alone when complete is estimated to reach 4,000 tons. She is 439 feet in length with a beam of just over 79 feet, and will draw nearly 28 feet of water.

She will carry an armament composed of four 12-inch guns, placed in turrets at bow and stern; ten 7.6-inch quick-fire guns, of which six are in turrets and the remaining four in casemates, two on the main deck forward and two on the lower deck aft; and twenty-eight lighter pieces of ordnance. The ten 7.6-inch guns are a change from the original design, which provided the "Democratie" with sixteen 6.4-inch weapons, of which twelve were carried by pairs in the turrets, which are now to contain a single 7.4-inch gun apiece. Besides her artillery the new ship will be provided with five torpedo tubes, two of which will be placed below the waterline, the remaining three being protected by the armored side.

The armor carried by the "Democratie" will be strong and extensive. She will have a complete armor belt at the waterline extending from stem to stern. It will have a maximum thickness of 11 inches amidships, but will taper off toward bow and stern. A lighter cuirass will surmount this, protecting her sides from all but the heaviest kinds of projectiles. On the top of the waterline belt will be an armored deck 2.4 inches in thickness, while the armor is reinforced lower down by a second deck 2 inches thick on the flat and 2.8 inches at the ends. The two main turrets will be covered with armor from 11 to 12½ inches in thickness, while the smaller turrets and casemates will have the protection of plating about half that thickness. The "Democratie" will have three screws actuated by three engines having a combined horse-power of 17,500. She will have, it is estimated, a full speed of 18 knots an hour and will carry 1,800 tons of coal in her bunkers. Her crew will consist of 793 officers and men, and it is hoped that she will be ready for commissioning in a couple of years' time.



Displacement, 14,800 tons; **Length,** 439 feet; **Beam,** 79 feet; **Draught,** 28 feet; **Armament:** four 12-inch, ten 7.6 inch, two submerged and two above-water torpedo tubes.

THE NEW FRENCH BATTLESHIP "DEMOCRATIE."

Probably few botanists would know how to distinguish the apple and pear when not in fruit, except, perhaps, in a general way by the habit of growth, the branches of the pear tree being usually more erect and outline more pyramidal. The horticulturist, however, has noticed that the young leaf of the apple unrolls on one side, but that of the pear on both sides at the same time.—Gard. Chron.

THE GOVERNMENT PHILIPPINE EXPOSITION.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

If one were called upon to name the one exhibit at St. Louis which, in its completeness and intrinsic value and interest, takes precedence over any other, his choice must surely fall upon the Philippine Exhibit, which was gathered together, constructed, and is now being run, under the auspices of the United States government. The name of its sponsors is of course a sufficient guarantee that this work has been done with conscientious thoroughness, and too much cannot be said in praise of the completeness and highly instructive character of this display. The object of this costly exhibit is to familiarize the people of the United States with the Philippine possessions. To quote the words of its officials: "One thing that has stood in the way of the proper development of any colonial possession by its governing country, has been the fact that a lack of knowledge of the real conditions and affairs of their colonies has blocked the way of the legislation most necessary for such development and exploitation." The credit for the work is due largely to the initiative of Secretary Taft, who induced the Philippine Commission to make an appropriation of over $1,000,000, for the purpose of securing and making an exhibit of Philippine products, manufactures, art, ethnology, and education, to say nothing of the customs and habits of the Philippine people, at the Louisiana Purchase Exposition. The work was carried out by a special board with Dr. W. P. Wilson, director of the Philadelphia Commercial Museum, at its head.

This unique exhibit, which occupies 47 acres of rolling woodland, contains nearly 100 buildings, which range in size and variety of construction from the hut of the aboriginal native to the palatial Spanish Administration Building. It contains in its various structures 75,000 catalogued exhibits, and no less than 1,300 representatives of the various Filipino tribes.

Entrance to the ground is made across a lagoon by means of the Bridge of Spain, which leads through a massive gateway into the walled city. This work is a reproduction of the actual structures at Manila, and it has been done with such perfection of architectural detail and such faithful coloring, that it carries all the atmosphere of the ancient structures of the city itself. In fact, the walls are an exact reproduction of those which encircle the city of Manila proper, and within them are found a collection of war relics, furnished by the United States army and the Philippine scouts and the constabulary. The lake crossed by the Bridge of Spain is a facsimile of the Laguna de Bay, and along its shores are built the Moro, the Bagobo, and the Visayan villages, while on its waters float several large *cascos* (or scows) and various marine craft used by the islanders. Now, it must be borne in mind that these villagers, the boats on the water, the utensils, and in fact everything pertaining to this exhibit, is of Philippine origin, the very material of which the villages are constructed having been brought over, together with the Philippine natives themselves, from our new possessions. The visitor can stroll through village after village, and see these naked savages wearing nothing but the loin cloth, following the round of their daily life, cooking, sleeping, and engaging in their pastimes and sports, exactly as they do in their native islands. They are a bright, sunny race, glad to talk with the *Americano,* and ever ready to respond, with a smile that shows their pearly-white teeth, to any questions which they are able to answer.

Down in the shady canyons of the Exposition grounds, and along the shores of the lake, one may study the Filipino as he was when the United States took charge of the islands. On the central plateau of the grounds above, may be seen the Filipino as the United States government has improved him; for here, strutting around in their natty khaki uniforms, and looking every inch the United States soldier, are to be seen several companies of the native scouts, a body of soldiers which owe their origin to that ever-to-be-lamented army officer, Gen. Lawton. The original body of scouts did good service under Gen. Lawton, and later under Gen. Young; and they proved so serviceable, and gave evidence of such good soldierly qualities, that in 1901 an act of Congress authorized the enlistment of 12,000 natives as scouts. They have always proved loyal, have all been under fire, and after the civil government took charge, the scouts formed part of the many garrisons throughout the island.

Here and there one meets representatives of the Constabulary Battalion, which is composed of 11 officers and 280 enlisted men. All the Christian tribes of the islands are represented in this battalion, and, like the scouts, they have done good service. The scouts have an excellent band, which gives daily performances on the main plaza of the Exposition.

Of the native tribes to be seen in the Exposition, the most primitive are the Negritos—little fellows of a distinctly negro type, who are remarkably skillful with the lance and the bow and arrow. Nothing makes them so happy as to show their skill, by knocking a five-cent piece out of the twig of a tree at a distance of fifteen paces.

Then there is the village of the Head-Hunting Igorotes, a race that is greatly superior to the Negrito, and a fine type of agricultural barbarians. They are copper colored, and the men have a splendid physical development, the women being also well formed and of graceful carriage.

In another village are the fierce Moros, one hundred of these fiery followers of Mohammed being present at the Exposition. The Samal Moros, of whom there are forty from the island of Mindanao, are the sea rovers

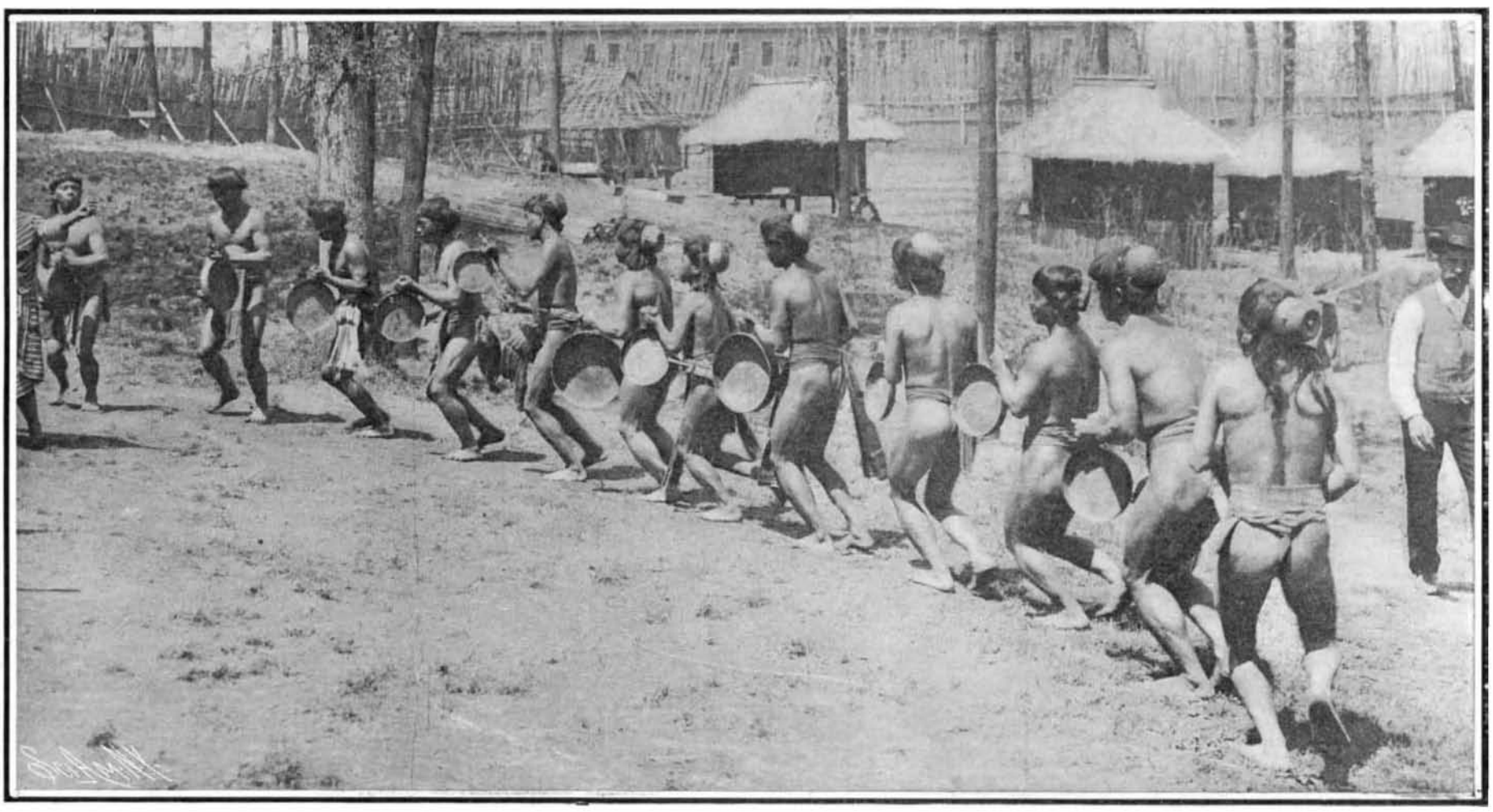
Antonio, Chief of the Igorote Head Hunters.

Model Village of Samal Moros (Pirates and Pearl Fishers).

Two Moro Dattos (Sub-Chiefs).

Model Tree House in Which Five Moros are Living.

Philippine Constabulary.



Photographs copyrighted 1904 by Louisiana Purchase Exposition Co.

Igorotes' Dance at the Fair.

THE GOVERNMENT PHILIPPINE EXHIBIT AT THE ST. LOUIS EXPOSITION.

or pirates. This tribe is about the most intelligent of all the tribes inhabiting the islands. Here also we find the spectacular Bagobo tribe, notable for their beautifully-ornamented costumes, who come from the highlands of the interior of Mindanao. Finally, we have the Christianized Visayans, with their village built over the waters of the lagoon. The people of these native tribes are all to be seen engaged in their native pursuits and manufactures.

The central plateau of the exhibit grounds is occupied by several buildings, many of which are reproductions of actual structures in the Philippines. There is the Agricultural Building, containing the work of the Bureau of Agriculture of the Philippine Islands during the past three years; and a most encouraging display it is, including exhibits of several hundred varieties of rice; of cotton and process of manufacture; of various grasses of hemp and other fibers; of tobacco, etc. Then surrounding the central plaza will be seen the Ayuntamiento, the Cathedral, the Commerce Building, and a typical Manila house, all of which are fine examples of the better class of Manila structures. The most striking of these is the Cathedral, which is a miniature reproduction of the cathedral at Manila. In this building are installed the exhibits of education, and part of the art exhibit.

Three years after the first landing of the American troops, the transport "Thomas" reached Manila Bay with a shipload of American teachers on board. After three years of work, the result may be summed up by stating that "*the English learned by the Filipino people in the past three years is greater in amount than the Spanish they acquired in the four hundred years of Spanish rule.*" The education exhibit shows the work of the elementary schools and the high schools, thirty-six of which latter have recently been established. One of the most charming features of this section is a Philippine school, shown in active operation in its schoolhouse of bamboo and Nipa palm—an exact duplicate of a country school building in the islands.

The Commerce Building on the south side of the plaza contains samples of the imports of the islands and the articles of native manufacture, while in the Manila Building is installed a collection of the textile fabrics of native manufacture, including exquisite laces, and embroideries so fair and delicate that one wonders how they have stood the transportation.

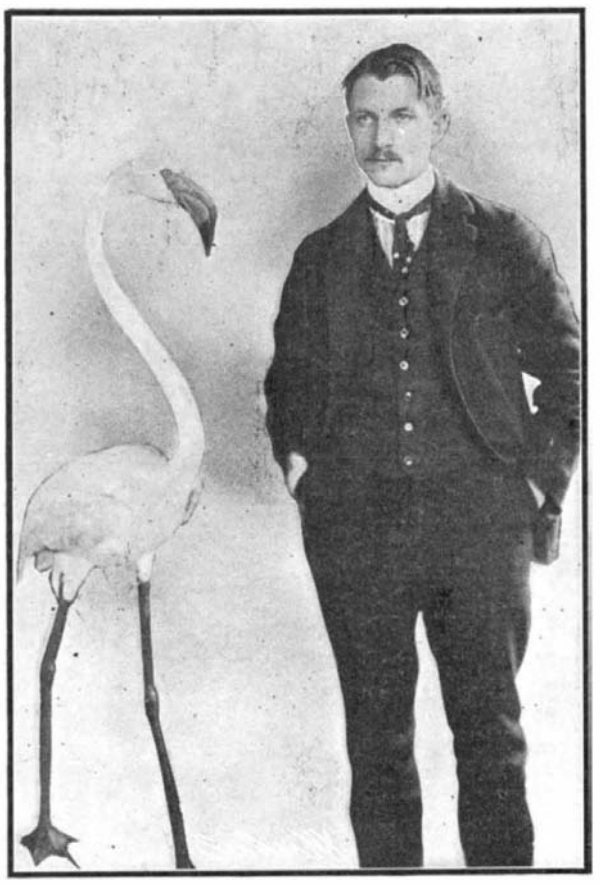
The Forestry Building is a large structure of hardwood framing and flooring, with Nipa sides and roofs. In its construction one hundred different kinds of woods indigenous to the islands were used; and it should be understood that the forests of the Philippines, which are of vast extent, form one of the most valuable assets of the government, containing, as they do, all the tropical hardwoods, such as ebony, mahogany, rosewood, etc. Limitations of space forbid any lengthy mention of the Ethnology Exhibit, and the Fisheries Exhibit on the shore of the lake, which includes one thousand mounted specimens of the different fish of the islands, and a collection of the native fishing gear, including bamboo fish traps and corrals, and the various styles of fishing boats.

The mineral wealth of the Philippine Islands, which is known to be very great, is as yet only in the preliminary stages of development. There are extensive beds of lignite and indications of petroleum. Gold exists in almost all of the islands, iron is abundant, and for many years the Igorote has made his own jewelry from the gold deposits of the Benguet Hills. A comprehensive display is made of the different native metals and minerals. Concluding our notice of this most creditable exhibit, it is not stretching the point too far to say that, if the average American citizen came to this great Exposition and did nothing more than spend his time within the government Philippine inclosure, the time and expense of his visit would be amply justified; for he can learn, during two or three days spent on these grounds, more about our new possessions than he could pick up in many months' travel throughout the islands themselves. Speaking for himself, the writer can say, that at the close of a most delightful day spent in these grounds, he left them with a distinct feeling of pride in the far-sighted wisdom of a government that could conceive and put into such splendid execution a project such as this. Moreover, the last doubt was removed from his mind that, in this matter of colonization, the latest and most difficult national enterprise upon which this nation has embarked, the government would achieve one of the most successful and beneficent works in the history of the United States.

THE FLAMINGO AND ITS QUEER NEST.

BY WALTER L. BEASLEY.

After considerable difficulty, Prof. Frank M. Chapman, of the Department of Ornithology of the American Museum of Natural History, has secured the first flamingo nests ever brought to this country.



THE BAHAMA FLAMINGO.

There are about seven species of flamingoes, three of which are in America, frequenting the Bahamas, Florida, and Cuba. In height the flamingo averages about five feet. If its curved neck were stretched to its full length the bird would tower above the head of an ordinary man. During May and June, the breeding time, the birds' bright-colored plumage is faded, but reassumes its most radiant hues in winter. When first hatched the young have a straight bill, which, after a time, develops into one of bent shape. The first plumage is grayish-white and passes through various tints of pink, rose, carmine, or vermilion to the full scarlet of the adult, which reaches its deepest shade on the wings. Several years are necessary to perfect the final gaudy plumage.

COLONY OF FLAMINGO NESTS, BAHAMA ISLANDS.

The eggs are white, showing a blue tint when scraped under the surface. They are long, oval, and have a thick shell, equaling in size that of the common goose. The flesh is not palatable to the taste, being extremely oily. The birds feed upon both animal and vegetable matter from the ooze and soft bottoms of the shallow waters and lagoons selected by them both as a feeding ground and nesting place. When flying their long legs are stretched out behind, and the neck is extended. They have a peculiar voice and a sort of one-syllable outcry, which they utter as an alarm signal the moment they are approached or believe themselves to be in danger. On account of their keen-eyed and wary nature it is almost impossible to get within close range of them.

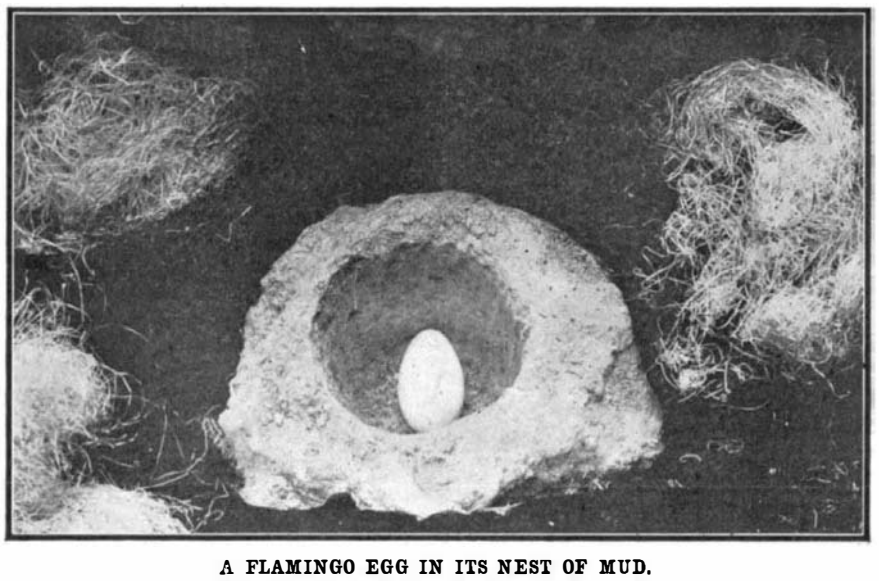
Prof. Chapman gives the following account of his work in the Bahamas:

During the winter the birds live chiefly on the west coast of the island, where the shallow water and soft marl bottom afford them an abundance of food and prevent pursuit either by boat or on foot; but in May they gather in some lagoon in the interior of Andros Island, far from the habitations of man, to rear their young. These breeding resorts are few in number and their whereabouts are comparatively unknown. We succeeded in reaching a large flamingo rookery well in the heart of Andros without undue difficulty. Our schooner was left at anchor behind the shelter of some outlying reefs, and the final part of the voyage was made in small boats.

The locality is only a few inches above the sea level, and is characterized by wide stretches of shallow lagoons bordered by red mangrove trees, with occasional bare bars of gray marl, and by outcrops of coralline rock so eroded and waterworn into bladelike edges and sharp, jagged pinnacles, that walking is attended by much danger. Our tents were pitched on a sand bar, and preparations made to visit the flamingo colonies known to exist in the vicinity.

Subsequent research showed that the locality was regularly frequented by these birds as a breeding resort, but that apparently a different spot was chosen each year. Eight groups or villages of nests were found within a radius of a mile, each evidently having been occupied only one year. The largest of these, placed on a mud bar only an inch or two above the level of the surrounding water, was a hundred yards in length, and averaged about thirty yards in width. An estimate, based on an actual count of a portion of this colony, gave a total of two thousand nests for an area of, approximately, only 27,000 square feet. This rookery we judged to have been occupied the previous year. At a distance of a mile we found nests scattered about in a dense growth of mangroves. Here the birds were found at work upon their nests for the present year.

A flock was seen which was estimated to contain about seven hundred birds—a sight of surpassing beauty. Although no shot was fired and a retreat was promptly made, the birds were disturbed by our intrusion, and either discontinued operations or removed to some other locality, and eventually we were forced to leave without seeing fresh nests. Those in process of building, however, told somewhat the manner of their construction. Those built among the mangroves were in an excellent state of preservation, a few even containing eggs. The task of getting these nests into the hold of the schooner was one of great difficulty. The largest secured measured 18 inches in diameter at the bottom, 13 inches at the top, and 9 in height, and weighed upward of 100 pounds.



A FLAMINGO EGG IN ITS NEST OF MUD.

Being one solid mass of mud and dried only externally, it needed only a slight jar to break the strongest of the nests into fragments, and the prospect of transporting the specimens to New York in safety seemed one of uncertainty. The Bahama negro boatmen were not accustomed to delicate work of this character, and it required special inducements in the way of pay to tempt them to wade barefooted through the lagoons and to travel over the keen-edged rocks with burdens of from 50 to 150 pounds on their heads.

The nests were placed in the canoe and reached the schooner with the breaking of only three out of nine specimens. In Nassau they were treated with a solution of gum arabic, which hardened them, and after being wrapped in plaster of Paris bandages they were packed separately in large boxes and reached New York in excellent condition. Specimens of the flam-

ingoes themselves were also secured. The nests collected differed from the conventional idea of a flamingo's nest in being much lower and of a greater diameter. Doubtless the height of the nest is governed by the rise of the water. Built wholly of mud, which is scooped up from about the base of the nest by the bird, it is necessary that the site chosen shall be near enough to water to insure an abundant supply of soft material. Such a site, however, brings the nest within reach of the tide, and places it in a low situation, which may be subsequently flooded by heavy rains. Consequently the birds must build their nests high enough to protect their contents from the water.

These two conditions have resulted in the production of a mud cone, which, in the colonies examined, was never more than twelve inches in height, but those as high as eighteen inches have been reported. In the slightly hollowed top of the adobe dwelling house a single white egg is laid.

The single nest here figured, however, has been excavated to a greater depth than the original in order to lighten it for transportation purposes.

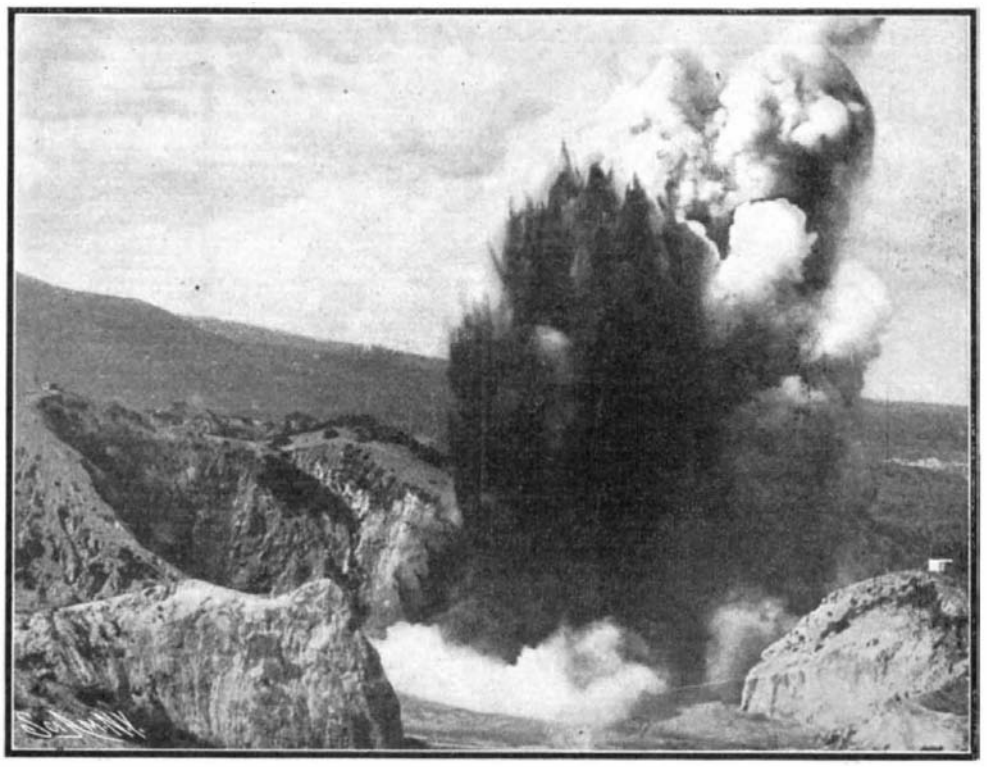
THE GREAT ROTORUA GEYSER OF NEW ZEALAND.

BY JAMES A. WARNOCK.

Yellowstone Park is reputed to have the most magnificent geysers in the world; but their reputation is based upon the statements of travelers who have never been to New Zealand, and who know nothing of its natural wonders.

Leaving Auckland by a fast express train, a journey of eight hours brings one to Rotorua, where may be seen the most splendid geyser which is probably to be found anywhere in the world. To give one some idea of the magnitude of the geyser, I need mention only the height of some of the surrounding objects. On the extreme left of the picture herewith reproduced, over the "Inferno Crater" (which contains a seething lake of water) is a small shelter shed, 450 feet above the plain. The surface of the water in the geyser basin, when at rest, is about 40 feet below this plain. From these figures it is easy to compute the height of the eruption. In the instance illustrated, that height must be about 900 feet. This is by no means exceptional. Higher "shots" have been recorded. I have myself seen a shot computed at 1,200 feet. Some months ago the area of the basin was measured in a small boat by a Mr. Buckeridge and a guide. They found that the area is about 2½ acres, from which it may be inferred that this geyser may well be called the largest in the world.

The geyser plays about twenty-two times each month, is very erratic, and gives no warning when it is about to erupt. The theory is advanced that the basin is somewhat like a funnel, and that when the water and stones are ejected, the larger stones return and jam in the neck, thereby choking the outlet, so that an enormous pressure of steam must shift them. When the pressure is sufficiently great to blow out the obstructions, it naturally would eject water to a great height. The theory, however, is at best rather fanciful.



THE GREAT ROTORUA GEYSER IN ERUPTION.

This geyser is not the only one to be seen in the vicinity. Others may be mentioned, such as the Pohutu, Wairoa, Feather, Papakura, and others, besides mud volcanoes.

A Saw-Proof Bar.

Perry D. Zeigler has invented a bar which cannot be sawed or cut through, for use in connection with prison-cells, windows or doors, and safety-vaults.

In carrying out his invention he takes a metallic bar of any suitable material, preferably iron or steel, and in the bar adjacent to its corners he provides longitudinal apertures. In the case of a round bar a number of apertures adjacent to its periphery are provided, and, if desired, as an extra precaution one or more holes may be present. The bar having been formed as described, molten glass or the like is poured into the apertures. After this has cooled, the inventor claims it would be impossible to saw through the bar, for the reason that the saw would not cut the glass, and only a partial fracture of the bar could be obtained.

Breaking of Staybolts.

Staybolts break more frequently in bad-water districts than in those districts where the water is freer from incrustating solids, says Mr. H. A. Fergusson, in a paper read before the Western Railway Club of America. This is not to be attributed to the action of the water on the bolts, but to the fact that such engines are washed out very much more frequently, with consequent vibration of the bolts each time. There is apparently no remedy for this, where water-purifying stations are absent, except a flexible staybolt, and while numbers of these have been designed and tried, there are none of them that will not become inflexible through the hard scale formations around the movable parts. The best bolt, therefore, is one which has the greatest flexibility, and which cannot be affected by scale.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

PRUNING-SHEARS.—C. F. CROSBY, Burlington, Vt. The object of this invention is to provide pruning-shears of simple, light, yet strong construction, having no parts liable to get out of order, and so arranged that there will be very little friction of the movable parts and with which a clean cross-cut may be made without drawing action, which would have a tendency to break the bark.

BEET-TOPPER.—J. M. CARAWAY, Longmont, Col. A distinguishing feature of the invention is the provision of an endless horizontal traveling belt provided with a spring-coil for holding the beets while being topped, and an oscillating knife or cutter, which is adapted to make a draw cut and is operated by the same means as the belt.

BINDER ATTACHMENT.—A. M. DAVIS, Madison, Wis. The object in view of the inventor in the present improvement is to decrease the friction attending the formation of the gavel in a self-binding harvester of any sort and also to assist in separating the bundle from the unbound grain. The means adopted enable the binder to be run more readily than ordinarily.

PLANTER.—A. D. EZZELL, Clinton, N. C. By Mr. Ezzell's invention corn, cotton, peas, etc., may be conveniently planted in rows, and the quantity of seed planted is regulated by means of the slide in the charger or rocking dropper, and the distance apart of the hills planted may be regulated by the projections or pins on the wheel, as the pins may be increased or decreased in number as desired. The apparatus plants seeds forty-two, twenty-one and fourteen inches apart.

Of General Interest.

PLATEN PRINTING-PRESS.—R. R. WILLIAMS, Marshfield, Wis. To obtain a perfect impression in platen-presses, the platen often requires to be adjusted higher or lower, corresponding to slight variations in the height of the type-form. Such adjustment is usually effected by several jack-screws, which operation requires much time, and it is also difficult to secure a perfect adjustment or one in which the platen will be perfectly parallel to the type-form. The adjustment can be made quickly and easily and with perfect accuracy.

ORDER AND RECORD FILE.—H. J. RIES, Iowa City, Iowa. In this patent the object of the invention is the provision of an improved means for recording and preserving orders and expense and other accounts in order of dates of the calendar—that is, day by day and month by month, the latter being summarized at the end of the year.

SASH-LOCK.—J. NOSEWORTHY, St. Johns, Newfoundland. The object in view in this case is the provision of a construction adapted for application to the opposing faces of the meeting sash-rails, so as to be concealed when sashes are closed and locked. The sashes automatically lock when closed. The lock is provided with a detachable operating device adapted to release the lock when it is desired to open the sash, the device when detached preventing access to the lock, so that it cannot be released by evil-disposed persons.

PIPE-STAND.—B. C. NEWLOVE, Walsenburg, Col. The special purpose in this instance is to provide means for supporting the outer end of a pipe while work is being done on the inner or opposite end. Such means to be practically effective must be stable, admit of easily shifting of the pipe in longitudinal directions, and of easy adjustment with respect to height at which the pipe is held. These requirements are answered in the structure, which consists in a base, a column, the length of which may be adjusted at will, and in a head, on which the pipe is supported to move freely longitudinally, these parts having special structure.

FASTENING DEVICE.—P. MORRISON, Chattanooga, Tenn. The invention relates to knockdown furniture, and its object is to provide for fastening two parts or members of furniture, crates, packing boxes, and other articles together without the use of screws, nails, or similar fastening means. the device being serviceable as a support for shelves and the like.

SCHOOL-LOOM.—BEATRICE E. LINDBERG, Faribault, Minn. In this case the invention relates to a device for teaching children the art of weaving and for enabling them to produce small woven articles. The improvement lies in an attachment which enables hammocks to be woven. The loom with the said attachment is particularly adapted to kindergarten purposes for weaving dolls' hammocks; but is adapted to hammocks of a large size.

SPLINE-WEIGHT.—F. K. LORD, Bayonne, N. J. The invention has reference to drawing instruments; and its object is to provide a spline-weight arranged to firmly hold the spline or batten in a curved position at any desired place on the drawing-surface to allow the draftsman to conveniently draw a line along the unobstructed front edge of the spline.

MASSAGE APPARATUS.—J. U. JONES and G. JONES, Chattanooga, Tenn. This apparatus is in the nature of a multiple vibrator and massage machine. The inventors provide a device for use by barbers, physicians, nurses, and others who desire to secure a vibra-stimulation or massage treatment, also for special use on the face, scalp or other portions of the body. In the practice it is found the machine runs smoothly and quietly, and is pleasant and beneficial in its effects upon a patient.

LUMBER-DRYING KILN.—C. H. HALL, Jacksonville, N. C. The invention has reference more especially to kilns for the drying of lumber, though well adapted to the drying of other materials. One of the principal objects thereof is to overcome numerous disadvantages and objections common to many other structures hitherto devised for similar purposes and to simplify and cheapen the cost of construction of the kiln, as well as to lessen the labor of management or control of the operations thereof.

Household Utilities.

COOKING DEVICE.—C. C. OVERTON, New York, N. Y. In this patent the invention pertains to an improved device for cooking meats, fish, and the like, in the oven of a stove, and at the same time imparting thereto the peculiarly delicate flavor of meats and fish cooked after what is commonly termed the "planking" process.

FOLDING BED.—D. F. KING, Louisville, Ky. The invention has reference to improvements in beds in which may be used a hinged box-mattress, the final objects being to secure a bed which when folded will offer to view the minimum upright surface, one in which can be used the comfortable type of mattress known as the "box-mattress," and one readily converted, when folded, into a settee, giving no hint of the concealed bed.

WINDOW-CLEANING CHAIR.—H. HARRISON, New York, N. Y. The purpose of the improvement is to provide a chair capable of being expeditiously and conveniently applied and fastened to windows of different widths and as conveniently removed. Another is to provide one which will constitute a safe and firm window-seat and which will guard the occupant at the back and sides, whether sitting or standing.

FUNNEL.—W. E. BURGESS, Dan-y-graig, Aberbeeg, England. The invention of Mr. Burgess relates to an improved funnel for filling vessels with liquid, and has for its object to provide means whereby during the filling operation the level of the liquid may be ascertained, the said level being exhibited externally of the vessel, so that the invention is of special utility in connection with the filling of casks and other vessels constructed of opaque materials.

Machines and Mechanical Devices.

PROPELLING APPARATUS FOR AIR-SHIPS.—A. V. WINEGARDEN, Leon, Kan. Broadly stated, the invention is embodied in two series of endless chains or bands that are spaced apart and travel on sprocket-wheels or pulleys arranged in a rigid frame and a series of sails or flexible sheets which are so connected with the said chains or equivalent that when traveling in one direction they are expanded and stretched, so as to act upon the air with greatest effect, and when moving in the reverse direction they collapse and practically feather, so as to offer minimum resistance to progress.

CIGAR-MAKER'S MACHINE.—E. WINTERER, New York, N. Y. It is a common practice for cigar-makers to thrust the head end of a cigar-bunch into the mouth to shape the bunch and to extract one or more pieces of tobacco filler with the teeth, and common to use gum or paste, flavored as with licorice, in order to make the "flag" of the wrapper adhere to the head in finishing the cigar. The inventor seeks to overcome unsanitary and contaminating objections by the provision of a simple machine which carries on the manufacture free from objections, lessens labor, facilitates work, and increases the output.

MACHINE FOR MAKING PIANO-HAMMERS.—E. T. WOLF, New York, N. Y. By this invention Mr. Wolf is able not only to reduce the cost of making hammers, but he produces hammers of a superior grade, the same being characterized by an improved pointed shape given to the striking-face formed by the condensed fibers of the felt covering at the end of the molding. He is also able to make all sets of hammers alike and uniform with respect to hardness and evenness of the felt by having an accurate gage of the amount of pressure applied.

Prime Movers and Their Accessories.

HYDRAULIC PRESS.—E. CROWE, Birchholm, Sheffield, England. The invention has for its object to effect economy of time and power, and so increase the speed of working and the efficiency of the press. This end is attained mainly by the provision of means whereby the idle descent of the presshead onto its work may be effected quickly and by gravity alone and whereby the power of the pumps is caused to come into action automatically immediately the tool carried by the press-head encounters the work. Mr. Crowe has invented another

hydraulic press, and both are a division of a copending application previously filed. The object of the present improvement is the same as the one above, and both relate to hydraulic presses for forging and other purposes—such, for example, as bending and testing armor-plates, flanging, and the like—in which the power for lifting the press-head is supplied from an accumulator or other source independent of that from which the power is derived for causing the head to perform its work.

WATER-MOTOR.—M. H. WHITE, Everett, Wash. This apparatus comprises a casing open at each end and having a flat base on which it may rest in upright position on the bed of a stream, so that the water flows through the casing. Placed longitudinally in the casing is a peculiarly-constructed screw, the plates of which are acted on by the current, whereby a rotary movement is imparted, and said movement is utilized for operating the pumps attached to the casing and by which the water is elevated. It is particularly useful for elevating water used for irrigating purposes.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Perforated Metals, Harrington & King Perforating Co., Chicago.

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METAL PATTERNS. For small castings. Fred Smith, Springdale Conn.

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If it is a paper tube we can supply it. Textile Tube Company, Fall River, Mass.

Inquiry No. 5784.—For parties to manufacture dental forceps of a special pattern.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5785.—For manufacturers of machinery by which garbage and street sweepings are converted into fuel.

WANTED.—Exclusive sale improved automobile specialties. Specialties, Box 773. New York.

Inquiry No. 5786.—For manufacturers of dies of different shapes for a press for making ornaments and flowers of sheet metal.

FOR SALE.—The Benson metal window screen frame. For cash, royalty or territorial rights. S. W. Benson, 1015 14th Street, Denver, Colo.

Inquiry No. 5787.—For manufacturers of concrete mixing machines.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5788.—For makers of electric motors.

Any metal, sheet, band, rod, bar, wire; cut, bent, crimped, punched, stamped, shaped, embossed, lettered. Dies made. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 5789.—For makers of novelties and domestic appliances.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5790.—For makers of windmills, tanks, etc., for country residences.

Patented inventions of brass, bronze, composition or aluminum construction placed on market. Write to American Brass Foundry Co., Hyde Park, Mass.

Inquiry No. 5791.—For machinery for making ordinary black powder, also for parties who build and plan powder plants.

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Inquiry No. 5793.—For machines for turning insulator pins, etc., for telegraph and telephone purposes.

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Inquiry No. 5800.—For portable storage bins.

Inquiry No. 5801.—For a dirt-elevating machine with a plow and elevator for grading roads.

Inquiry No. 5802.—For a reversible steel road machine for cutting down banks and widening roads.

Inquiry No. 5803.—For the manufacturers of the Thomson Houston electric rock drill.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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(9432) W. K. F. says. Will you kindly answer me in the Notes and Queries of the SCIENTIFIC AMERICAN, the following questions: (a) Which would be better to measure the capacity of a 5x7 Crowfoot battery? (b) What should it register? (c) How can any deficiency to register the proper amount be made up? A. A voltmeter will measure the e.m.f., and an ammeter will give you the current in a Crowfoot cell. The voltage is usually about 1.07 volts in a cell freshly set up, and in an old cell may be less than a volt. The amperes depend upon the external resistance, the distance between the zinc and the copper, the strength of the solution, and other things. If a cell is run down, the clear liquid at the top should be siphoned off, and water should be added to bring the liquid up over the zinc.

(9433) W. C. asks: Being a constant reader of your valuable paper, I take the liberty of asking the following questions: Suppose a train traveling at the rate of a mile per minute carries a gun which sends a ball with the same velocity as the train. What would be the result? In other words, would the ball reach a given point in advance of the train? What would be the result if the gun were discharged in the opposite direction? A. As a constant reader of the SCIENTIFIC AMERICAN you should have seen the problem of the gun fired on a moving train discussed several times in recent years. You will find it in Queries 8823, 8862, and 9270. The principle is simple. The gun will do the same to the ball as if the train did not exist. The train will do the same to the ball as if the gun did not exist. Newton's law is "A given force will produce the same effect, whether it acts alone or with other forces." If the ball were discharged in the same direction as that of the train, the ball would go forward with two motions, that of the train and that of the gun. It would thus go ahead of the train a mile a minute. If shot in the opposite direction, the train would carry the ball forward and the gun carry it backward at the same time, a mile a minute. The ball would therefore drop directly from the mouth of the gun to the ground. It is the same with throwing a package from a moving train. Throw it backward if you want it to drop to the ground.

(9434) R. R. asks: Please answer the following question in Notes and Queries column: Can the coils and instruments necessary to produce the Hertzian waves for a wireless telegraph transmitter, to be used with a receiver like that mentioned on page 347 of SCIENTIFIC AMERICAN of April 30, be made by an amateur; if so, where could I get the necessary information? A. Any person with some mechanical ability and experience may confidently undertake to make the wireless telegraph apparatus described in our issue of September 14, 1901. With some knowledge of electrical work, there is no reason to apprehend failure to make it do its work well. The necessary information is given in the paper referred to above. Special instructions for making an induction coil are given in Norrie's "Induction Coils," price $1. It will be better to buy a relay and sounder than to try to make one.

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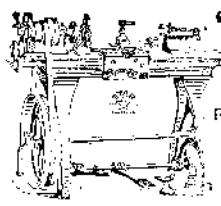

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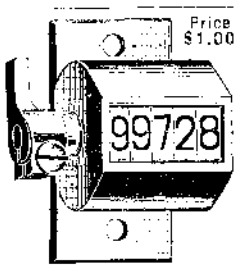

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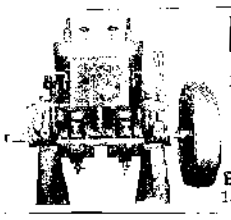

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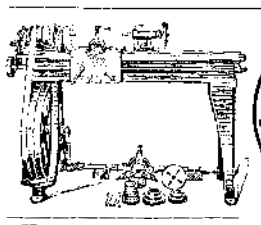

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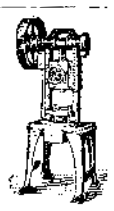

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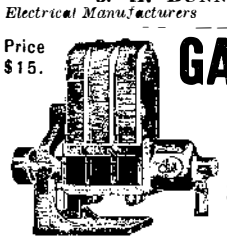

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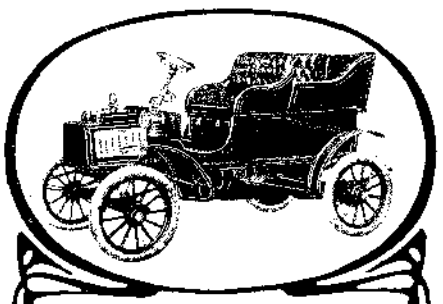

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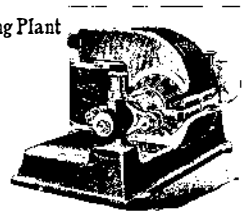

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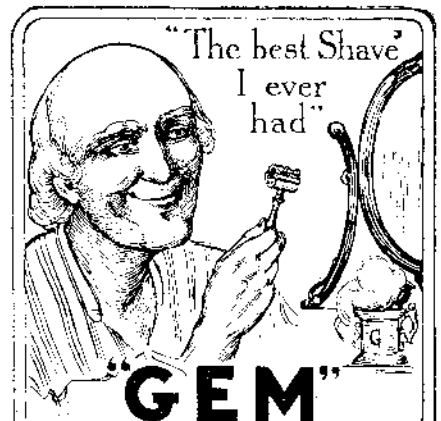

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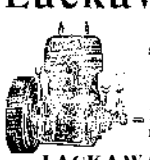

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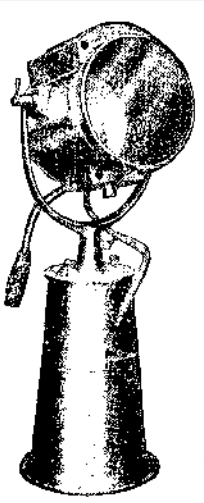

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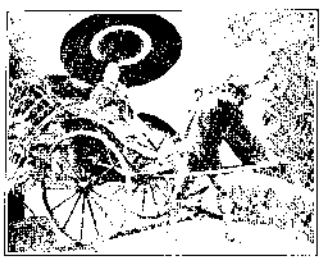

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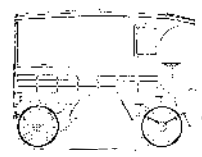

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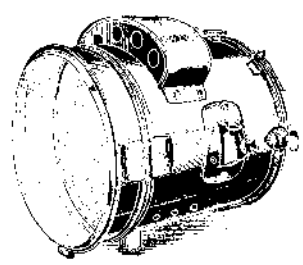

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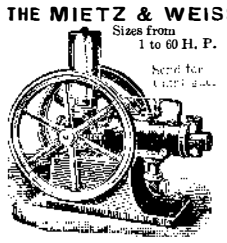

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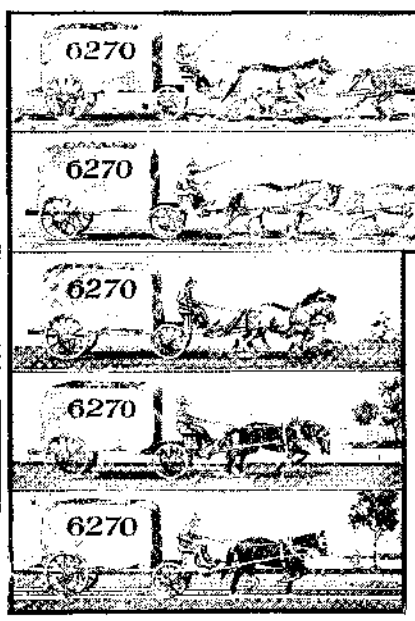

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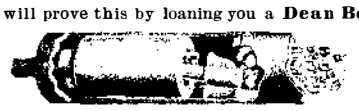

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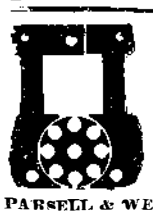

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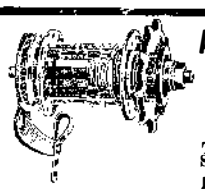

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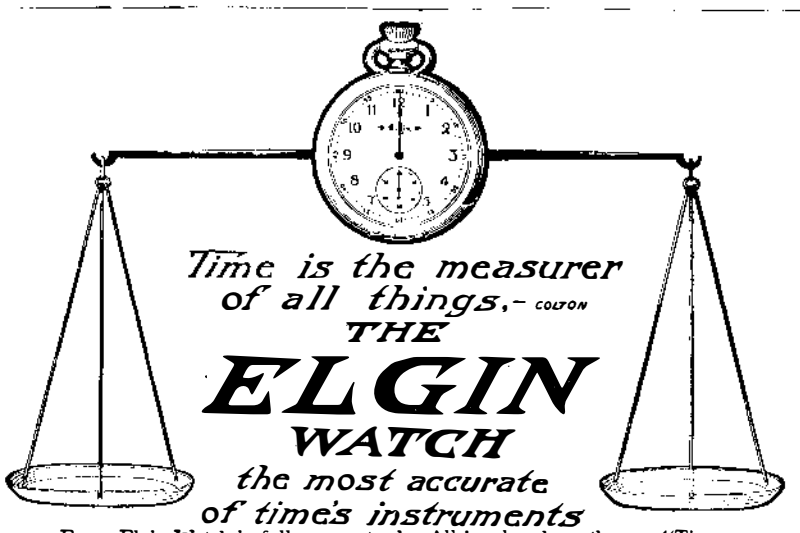

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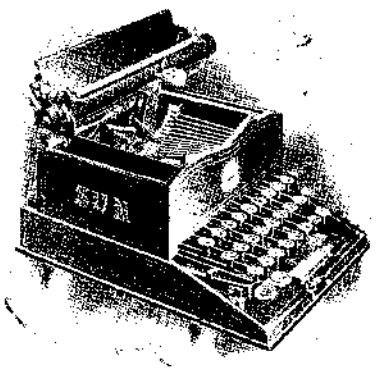

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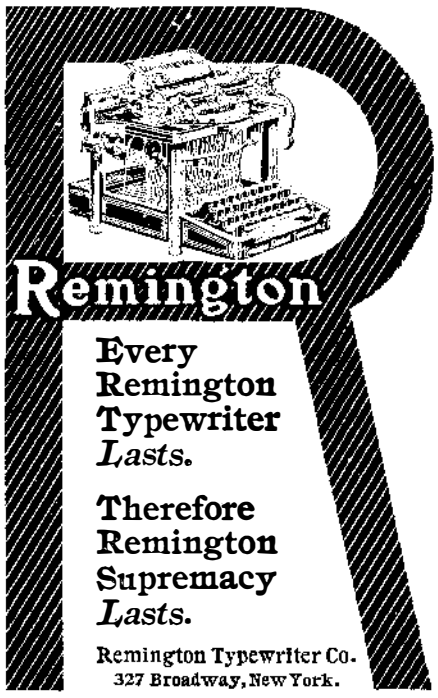

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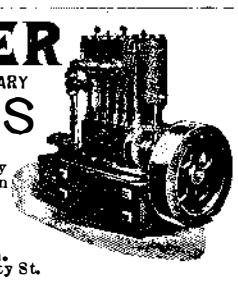

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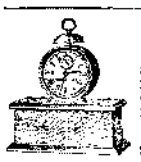

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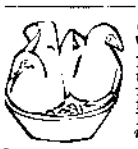

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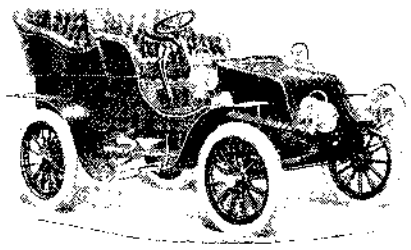

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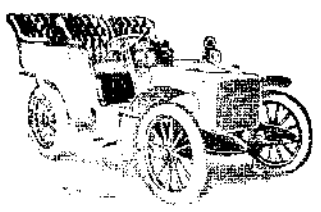

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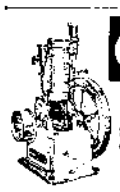

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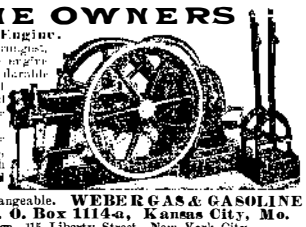

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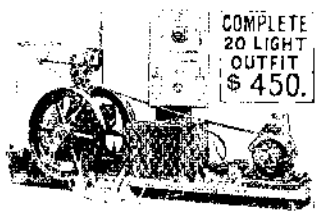

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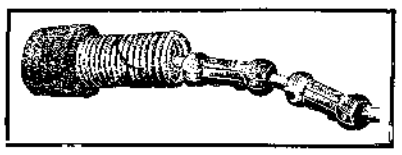

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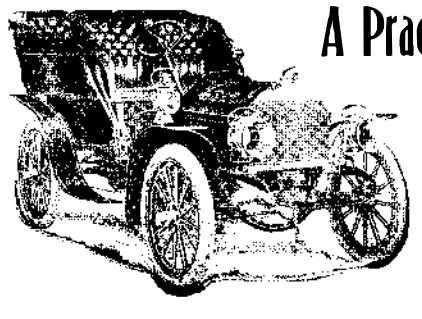

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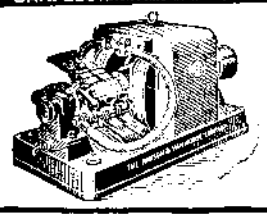

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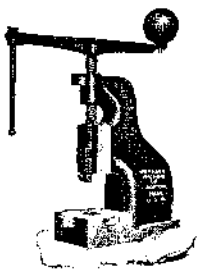

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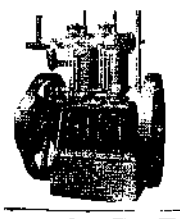

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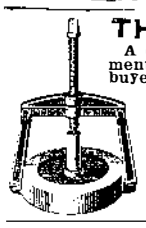

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